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Geology of the Ferrier Lake–Canoeshed Lake Area

District of Sudbury

by
E.G. Bright

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FOREWORD

FERRIER LAKE–CANOESHED LAKE AREA

The Ferrier Lake-Canoeshed Lake area contains occurrences of copper, zinc, gold, silver, asbestos, iron, and nickel. In 1967 only partial geological map coverage was available for this region, the most recent consisting of reconnaissance level information recorded in 1926. A series of detailed mapping projects was initiated to provide a more effective basis for future regional geological mapping and compilation programs in this region. Together these programs will lead to a regional synthesis and interpretation of the geology and mineral potential of that portion of the Archean Abitibi Belt between Timmins and Shining Tree.

V.G. Milne
Director
Ontario Geological Survey

CONTENTS

	PAGE
Abstract	ix
Introduction	1
Location and Access	1
Physiography	1
Previous Geological Work	2
Field Work	2
Acknowledgments	3
General Geology	3
Table of Lithologic Units	4
Early Precambrian (Archean)	6
Metavolcanics	6
Mafic and Intermediate to Mafic Metavolcanics	6
Ultramafic Metavolcanics	10
Felsic Metavolcanics	11
Conglomerate	13
Iron Formation	13
Metamorphosed Mafic and Ultramafic Intrusive Rocks	15
Mafic Sills, Dikes, and Irregularly Shaped Intrusions	15
Ultramafic to Mafic Sills	17
Ultramafic Sills	18
Felsic Intrusive and Metamorphic Rocks	18
Early Granitic Rocks	18
Peterlong Lake Complex	19
Late Granitic Rocks	19
Moher Pluton and Related Epizonal Dikes	20
Geikie and West Nighthawk Lake Plutons and Related Epizonal Dikes	21
Late Mafic Intrusive Rocks	22
Diabase	22
Middle to Late Precambrian (Proterozoic)	23
Huronian Supergroup	23
Cobalt Group	23
Gowganda Formation	23
Mafic Intrusive Rocks	23
Diabase	23
Northeast-Trending Quartz Diabase Dikes	23
Northwest-Trending Olivine Diabase Dikes	24
Cenozoic	25
Quaternary	25
Pleistocene and Recent	25
Structural Geology	26
Folding	26
Faulting	27
North-Northwest-Trending Faults	27
Northwest-Trending Faults	28
Northeast-Trending Faults	28
Economic Geology	29
Gold	29
Copper	30
Asbestos	31
Nickel	31
Description of Properties, Occurrences, and Exploration	32
Amax Exploration Incorporated	32
Parting Lake Group (21)	33
Foy Lake Group (22)	33
Adele Group (30)	33
Luke Lake Group (31)	33
Shear Lake Group (32)	34

Boychuck, F. (South Muskasenda Group) (4) 34
Boychuck, F. (West Muskasenda Group) (5) 36
Canadian Nickel Company Limited [1964] (11) 37
Conigo Mines Limited (6) 38
Daniel Mining Company Limited (23) 38
Dominion Gulf Company [1951-1952] (12) 38
Dominion Gulf Company [1951-1952] (24) 39
Dominion Gulf Company [1951-1953] (7) 40
Fox Occurrence (33) 41
Helpert, J. [1971] (13) 41
Hollinger Occurrences 42
Cork Lake Group (25) 42
Ferrier Lake Group (9) 43
Redstone River Groups (8, 26, 34) 43
Luke, J. [circa 1925] (35) 45
Noranda Exploration Company (15) 45
North Moher Lake Occurrence (3) 46
PCE Explorations Limited [1965] (27) 46
Phelps Occurrence (14) 48
Probe Mines Limited (28) 48
Robinson Occurrence (16) 48
Sommerville Occurrence (1) 49
Spirit Lake Mines Limited (29) 49
Sylvanite Occurrence (2) 50
Texmont Occurrence (10,17) 51
Vipond and Heard Occurrence (18) 52
Voyager Explorations Limited (19) 52
West Nighthawk Lake Occurrence (20) 54

References 55
Index 57

TABLES

1–Table of Lithologic Units 4

2–Chemical analyses of metavolcanics from within and adjacent to the Ferrier Lake-Canoeshed Lake area 7

FIGURES

1–Key map showing location of the Ferrier Lake-Canoeshed Lake area viii

2–Location of the gold showing and surface diamond-drill holes on the F. Boychuck (South Muskasenda group) property in western English Township 35

3–General geology of the sulphide zones and location of surface diamond-drill holes on the property of Noranda Exploration Company in southeastern Zavitz Township 47

4–General geology of the sulphide zones and location of surface diamond-drill holes on the property of Voyager Explorations Limited in southeastern Zavitz Township 53

GEOLOGICAL MAPS

(back pocket)

Map 2289 (coloured)–Beemer and Moher Townships, District of Sudbury.
Scale 1 inch to ⅛ mile (1:31 680).

Map 2290 (coloured)–English and Zavitz Townships, District of Sudbury.
Scale 1 inch to ⅛ mile (1:31 680).

Map 2291 (coloured)–Semple and Hutt Townships, District of Sudbury.
Scale 1 inch to ⅛ mile (1:31 680).

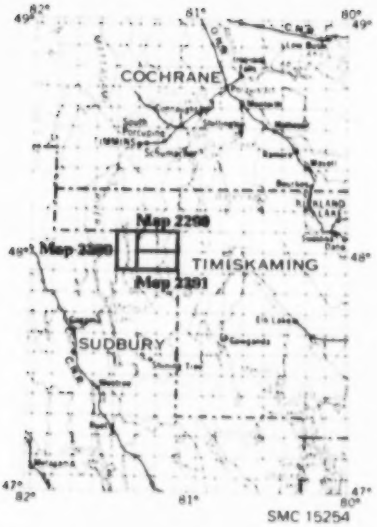

Figure 1–Key map showing location of the Ferrier Lake-Canoeshed Lake area. Scale 1:3 168 000 (1 inch to 50 miles).

ABSTRACT

This report describes the geology, structure and mineral occurrences of Beemer, English, Zavitz, Moher, Semple, and Hutt Townships (Ferrier Lake-Canoeshed Lake area), an area of 560 km^2 located in the District of Sudbury about 50 km south of the city of Timmins.

The map area forms part of the Abitibi Metavolcanic-Metasedimentary Belt of the Superior Province of the Canadian Shield. Most of the bedrock consists of Early Precambrian metavolcanic and plutonic rocks. Bedrock exposure is poor due to thick Pleistocene glacial deposits of silt and sand. The central and eastern parts of the area are largely underlain by mafic, intermediate, and felsic metavolcanics with subordinate units of iron formation; minor units of ultramafic metavolcanics and metasediments are also present. Two cycles of volcanism are recognized in the northern part of the area. The oldest cycle in Beemer, English and western Semple Townships consists of a lower sequence of mafic to intermediate metavolcanics and an upper sequence of felsic metavolcanics. A younger volcanic cycle in Zavitz Township consists of a lower unit of ultramafic metavolcanics and an upper sequence of mafic to intermediate metavolcanics. The stratigraphic succession of the mafic to felsic metavolcanics in Hutt and eastern Semple Townships, the southeastern part of the map area, is not firmly established. Numerous small, early tectonic, mafic to ultramafic sills and several large, layered, mafic to ultramafic sill complexes intrude the metavolcanics, in particular the felsic metavolcanics.

During the regional east-west folding of these rocks, the western part of the area was intruded by the margin of a large granitic batholith composed mainly of granodiorite and trondhjemite. Late tectonic stocks of porphyritic quartz monzonite, porphyritic granodiorite, and in places porphyritic syenite were subsequently emplaced within the metavolcanic succession. Regional metamorphism ranges from lower greenschist facies to amphibolite facies near the margin of the batholith.

All these rocks were subsequently intruded by diabase dikes of Early and Late Precambrian age.

No economic mineral deposits have been outlined in the area; however, economically interesting occurrences of copper, zinc, gold, silver, asbestos, iron, and nickel are present.

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CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

If the reader wishes to convert imperial units to SI (metric) units or SI units to imperial units the following multipliers should be used:

CONVERSION FROM SI TO IMPERIAL			CONVERSION FROM IMPERIAL TO SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy)/ton (short)	20.0	pennyweights/ton (short)
1 pennyweight/ton (short)	0.05	ounce (troy)/ton (short)

NOTE–Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries published by The Mining Association of Canada in co-operation with the Coal Association of Canada.

Geology
of the
Ferrier Lake-Canoeshed Lake Area
District of Sudbury

by

E.G. Bright[1]

INTRODUCTION

Location and Access

The Ferrier Lake-Canoeshed Lake area is located in the District of Sudbury, about 50 km south of the City of Timmins, and is bounded by Longitudes 81°28′W to 81°49′W and Latitudes 47°55′ to 48°06′N. The area covers about 560 km^2 and includes Beemer, English, Zavitz, Moher, Semple, and Hutt Townships.

The area can be reached by two secondary road systems which connect Timmins, Matachewan and Shining Tree. One road extends south from Timmins, through the central part of English and Semple Townships to connect with the Grassy River Road and finally Highway 560 near Shining Tree. This is an all-weather gravel road from Timmins to central Bartlett Township. The other (the Wicks Road) extends west from Matachewan, across the central part of the area, to connect with the road from Timmins in English Township. Peterlong and Kapiskong Lakes provide excellent water access to Beemer and Moher Townships, the western part of the area. Float-equipped aircraft may be utilized on the numerous lakes in the eastern part of the area.

Physiography

The topography is one of low relief, generally less than 30 m. The numerous north-trending esker trains which traverse the entire area account for local re-

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lief of up to 90 m. A prominent ridge of intermittent outcrop with relief in excess of 30 m trends south-southeast across the central part of the area from Muskrat Lake in northeastern English Township to Canoeshed Lake in western Hutt Township. This ridge separates two major esker complexes which together with recent swamp deposits mantle most of the bedrock in English and Semple Townships on the west, and the central part of Zavitz and Hutt Townships on the east.

Two main river systems, the Grassy and the Redstone, drain the central and western parts of the area northward towards James Bay. The eastern part of the area is also drained by the Grassy River, but here the drainage is southward. The Grassy River, which has its source in Zavitz Township, flows southward through and beyond Hutt Township. From here, it maintains a southwesterly flow for about 32 km before reversing directions to a northwesterly course that eventually takes it northward through Kapiskong and Peterlong Lakes in Moher and Beemer Townships. Secondary drainage along the northern boundary of the map area is provided by the Mountjoy River via Muskasenda Lake and the Nighthawk River via Kitchiming Lake.

Previous Geological Work

The first geological survey in the area was undertaken by E.M. Burwash (1896) of the Ontario Bureau of Mines, during the cutting of the Algoma-Nipissing boundary.

In 1899, W.A. Parks (1900) travelled the Grassy River by canoe from its mouth to Peterlong Lake and described some of the rocks along the route.

In 1925, Gledhill (1926) mapped the Grassy River area at a scale of 1 inch to 1½ miles; the Ferrier Lake-Canoeshed Lake area forms the northern part of this map area.

Halliday and Midlothian Townships, adjacent to the southeastern corner of the present map area, were mapped by Bright (1970) in 1966 at a scale of 1 inch to ¼ mile.

In 1971, Bartlett and Geikie Townships, which border the northern part of the area, were mapped by Pyke (1972a,b). The following year, Pyke (1978a) carried out a geological mapping and compilation program of the Peterlong Lake area at a scale of 1:50 000; Beemer, English, and Zavitz Townships form part of the southern half of this area.

Field Work

The field work for this report was carried out during the summers of 1967 and 1968. Vertical aerial photographs at a scale 1 inch to ¼ mile (1:15 840) were used in the field and all outcrop areas visible on these photographs were examined. Since most of the area is mantled by glacial deposits, systematic pace-and-compass traverses were made at ¼ mile (0.4 km) intervals. The geology was tied to water courses, lakes, roads and all other identifiable landmarks on the aerial photographs.

Uncoloured preliminary maps, at a scale of 1 inch to ¼ mile, were issued in 1968 for the six townships comprising the Ferrier Lake-Canoeshed Lake area (Bright 1968a,b,c,d,e,f). Geological Maps 2289, 2290, and 2291 which accompany this report were issued in 1974 at a scale of 1 inch to ½ mile (1:31 680). The field work of 1967 and 1968 was augmented by property examinations in the area by the author, as well as the 1972 regional mapping of the Peterlong Lake area by Pyke (1978a).

Acknowledgments

In 1967, the author was assisted in the field by Thomas Clark, senior assistant, and T.W. Caine, K.W. Carter and J.R. Bowlby, junior assistants. In 1968, the author was assisted by B.J. Cutt, senior assistant, and T.W. Caine, G.A. Sugar and J.W. Atchinson, junior assistants. Their assistance and cooperation is appreciated.

The author extends special thanks to D.R. Pyke of the Ontario Geological Survey for his assistance and many helpful discussions on the regional geology of the area.

GENERAL GEOLOGY

The Ferrier Lake-Canoeshed Lake area is situated between Timmins and Shining Tree in the west-central part of the Abitibi Metavolcanic-Metasedimentary Belt in the Superior Province of the Canadian Shield. The bedrock units (Table 1) consist mainly of Early Precambrian (Archean) metavolcanics and mafic to felsic plutonic rocks; however, a few Middle to Late Precambrian diabase dikes are present. Most of the bedrock is mantled by thick Pleistocene glacial deposits of silt and sand, or recent alluvium.

The central and eastern parts of the area are largely underlain by isoclinally folded mafic to felsic metavolcanics with subordinate units of iron formation; minor units of ultramafic metavolcanics and metasediments are locally present. Two cycles of volcanism are recognized in Beemer, English, and Zavitz Townships, the northern part of the area. The oldest cycle, mainly in Beemer and English Township consists of a lower sequence of mafic to intermediate metavolcanics and an upper sequence of felsic metavolcanics. Oxide and sulphide facies iron formations are restricted to the upper sequence of felsic metavolcanics. A younger volcanic cycle to the east in Zavitz Township consists of a lower unit of ultramafic metavolcanics and associated Mg-rich mafic metavolcanics, and an upper thick sequence of mafic to intermediate metavolcanics. The stratigraphic succession of the mafic to felsic metavolcanics in Hutt and eastern Semple Townships, the southeastern part of the map area, is not firmly established.

Prior to regional deformation and metamorphism, numerous small mafic to ultramafic sills and stocks and several large, layered, mafic to ultramafic sill complexes preferentially intruded the felsic metavolcanic sequences. Some mafic dikes associated with these intrusions may in part represent feeders to

TABLE 1 TABLE OF LITHOLOGIC UNITS FOR THE FERRIER LAKE-CANOESHED LAKE AREA

PHANEROZOIC

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Sand, silt, gravel, stony sand till, and swamp and stream deposits.

Unconformity

PRECAMBRIAN

MIDDLE TO LATE PRECAMBRIAN (PROTEROZOIC)

MAFIC INTRUSIVE ROCKS

Olivine diabase, quartz diabase.

Intrusive Contact

HURONIAN[a]

COBALT GROUP

GOWGANDA FORMATION

Conglomerate.

EARLY PRECAMBRIAN

MAFIC INTRUSIVE ROCKS

Diabase.

Intrusive Contact

FELSIC INTRUSIVE AND METAMORPHIC ROCKS

LATE GRANITIC ROCKS

Porphyritic biotite quartz monzonite, biotite granite, alaskite; biotite-hornblende granodiorite, biotite-hornblende syenite, porphyritic syenite; aplite, felsite, quartz-feldspar porphyry, lamprophyre.

EARLY GRANITIC ROCKS

Gneissic biotite-hornblende granodiorite, trondhjemite, and quartz monzonite; hornblende quartz diorite, diorite gneiss, hybrid granodiorite and amphibolite gneiss.

Intrusive Contact

METAMORPHOSED MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS[b]

Gabbro, quartz gabbro, diorite, peridotite, pyroxenite, serpentinized ultramafic rocks (sills and flows).

Intrusive Contact

METAVOLCANICS AND METASEDIMENTS[c]

METASEDIMENTS[d]

Iron Formation: magnetite-chert, sulphide-chert, chert, and pyritic-graphitic slate varieties.

Conglomerate, with minor tuffaceous siltstone and graphitic slate interbeds.

INTERMEDIATE TO FELSIC METAVOLCANICS[d]

Dacitic to rhyolitic massive flows, tuff, lapilli-tuff, volcanic breccia (termed tuff-breccia, flow-breccia and agglomerate); massive, porphyritic, amygdaloidal and pillowed dacitic flows; sericite schist, chlorite-sericite schist.

MAFIC TO INTERMEDIATE METAVOLCANICS[d]	Dark coloured (actinolitic) massive and pillowed basaltic to andesitic flows; dark coloured variolitic, amygdaloidal and porphyritic flows, minor tuff and agglomerate; light coloured (tremolitic) massive, porphyritic and pillowed andesitic flows; amphibolite gneiss and schist; chlorite schist, sericite-chlorite schist.
ULTRAMAFIC METAVOLCANICS[d]	Massive and spinifex-textured serpentinized flows; serpentinized ultramafic subvolcanic sills.

Notes
(a) Huronian metasediments do not occur in the area as previously reported on Map 2290.
(b) Some ultramafic units are flows.
(c) The metavolcanic and metasediments in this table and in the body of the report are described and classified differently from that shown on Maps 2289, 2290 and 2291, back pocket.
(d) These rocks are divided lithologically and their positions in this table does not imply age relationships.
(e) Originally mapped as dacitic rocks and coded 3b, 3e and 3g on Map 2291.

the overlying mafic to intermediate metavolcanics.

During regional east-west folding, the metavolcanics in the western part of the area were intruded and partially engulfed by the Peterlong Lake Complex, the northeastern margin of a large batholith composed mainly of granodiorite and trondhjemite. Regional metamorphism ranges from lower greenschist facies in the interior portions of the metavolcanic belt to amphibolite facies near the margins of the batholith. The Moher Pluton, a large late tectonic intrusion of porphyritic quartz monzonite, was subsequently emplaced along part of the contact between the Peterlong Lake Complex and the metavolcanics. At this same time, the Giekie porphyritic granodiorite and several related smaller stocks and dikes of porphyritic granodiorite and syenite intruded various parts of the main metavolcanic belt. Metamorphism under albite-epidote hornfels and hornblende hornfels facies conditions occurred within the narrow contact aureoles of the late granitic plutons. During the emplacement of these stocks, the previously deformed strata was locally cross-folded along north- to northwest-trending axes.

Subsequently, these rocks were intruded by Early Precambrian north-northwest-trending diabase dikes and Middle to Late Precambrian northwest- and northeast-trending diabase dikes.

In the northwestern part of the map area, the metavolcanics adjacent to the Peterlong Lake Complex form a steep dipping, east-facing homoclinal succession. A complimentary northeast- to east-plunging synform forms the major fold structure in the southern and eastern parts of the area; subsidiary folds plunge eastward in the western part of this structure, whereas those in the eastern part plunge westward.

Numerous north-northwest-trending and northwest-trending faults traverse the area.

Early Precambrian (Archean)

METAVOLCANICS

Mafic and Intermediate to Mafic Metavolcanics

For field mapping purposes, the mafic to intermediate metavolcanics were divided into basaltic rocks (units 1a to e on maps, back pocket), andesitic rocks (units 2a to e), and dacitic to andesitic rocks (units 3e and g). In general, the field name was based predominately on a colour index defined by mafic mineral content. Basaltic rocks are dark green and grey to black on fresh surfaces and dark grey to grey-green or rusty brown on weathered surfaces; andesitic rocks are medium grey and green to dark green and have medium grey to light green weathered surfaces. Thin section examination and limited chemical analysis (Table 2) carried out subsequent to the publication of the maps have indicated that many of the light grey-green metavolcanics in central Hutt and northwestern Zavitz Townships, originally mapped as dacitic breccias and dacitic to andesitic lavas (units 3b, d, e and g on maps, back pocket), are much more mafic in composition. Metamorphic mineral assemblages, except in the contact aureoles of granitic rocks are indicative of the greenschist facies of regional metamorphism. Recrystallized basaltic and andesitic rocks consist primarily of amphibole and saussuritized plagioclase, with lesser amounts of clinozoisite-zoisite, epidote, chlorite, and quartz; magnetite and leucoxene are the main accessory minerals. The original plagioclase is altered to sodic plagioclase, predominantly albite. The main mafic constituent in the grey-green to black metavolcanics is pale green to dark green chloritized actinolite. Primary subophitic to ophitic volcanic texture is often preserved in the darker coloured actinolitic metavolcanics. In contrast, the main mafic constituent in the light grey-green mafic metavolcanics is tremolite showing variable alteration to very pale green to colorless Fe-poor chlorite. These light-coloured tremolitic, mafic to intermediate metavolcanics are also somewhat harder than the darker-coloured, more Fe-rich actinolitic type and commonly break with a subconchoidal fracture. This results from a fine-grained tremolite-clinozoisite-zoisite metamorphic asemblage present in the light-coloured rocks, which is harder than the actinolite-chlorite-epidote assemblage in the darker-coloured rocks.

In northeastern Beemer, central Moher, southwestern English and western Semple Townships, mafic to intermediate metavolcanics form a steeply dipping, east-facing homoclinal sequence adjacent to the Peterlong Lake Complex and the Moher Pluton. This metavolcanic sequence, probably the oldest in the area, consists almost entirely of massive and pillowed, actinolitic flows. Flow units are uniformly fine-grained and probably thin, but flow contacts were not observed; porphyritic and amygdaloidal varieties were rarely seen and only a few flows were found with coarse-grained flow centers and brecciated flow tops. A representative chemical analysis of tholeiitic basalt from this sequence is given in Table 2 (Sample No. B-29-71). Minor interflow units of andesitic tuff and agglomerate occur at or near the top of the sequence to the west of Muska-

TABLE 2 | CHEMICAL ANALYSES OF METAVOLCANICS FROM WITHIN AND ADJACENT TO THE FERRIER LAKE - CANOESHED LAKE AREA.

MAJOR ELEMENT OXIDES	A-1	P-2-72	B-29-71	P-242-72	P-188-72	P-27-71
	WEIGHT PERCENT					
SiO_2	47.72	38.60	51.90	51.00	53.30	66.70
Al_2O_3	10.02	3.69	12.90	14.00	13.10	15.20
Fe_2O_3	11.24	7.02	1.40	1.98	2.75	.72
FeO		3.67	10.50	8.55	11.10	2.23
MgO	19.63	33.30	6.90	7.70	4.04	1.45
CaO	3.30	3.23	9.15	8.90	7.66	3.39
Na_2O	—	.19	2.34	2.12	2.20	4.03
K_2O	—	.02	.15	.70	1.23	2.03
TiO_2	—	.27	.96	.83	1.62	.56
P_2O_5	—	.05	.08	.08	.20	.14
S	—	.04	.01	.01	.01	.01
MnO	—	.16	.21	.26	.26	.13
CO_2	1.10	.23	.15	.86	.19	1.12
H_2O+	5.24	8.86	1.96	2.75	1.74	1.58
H_2O-	—	.10	.05	.11	.03	.10
TOTAL	98.25	99.40	98.66	99.85	99.43	99.39

Sample Locations:

P-2-72 Massive ultramafic metavolcanic, Geikie Township one mile northeast of Texmont Mine. Sample is from a 7-foot thick flow, mid-way between the basalt contact and spinifex-textured top (Pyke 1978b).

B-29-71 Pillowed mafic metavolcanic, southwest corner of Bartlett Township (Pyke 1978b).

P-242-72 Pillowed mafic metavolcanic (tremolitic type), ½ mile south of Wicks Road, on power line in Hutt Township (Pyke 1978b).

P-188-72 Pillowed mafic metavolcanic (actinolitic type) from copper showing near southern part of Kitchiming Lake in northeast Zavitz Township (Pyke 1978b).

P-27-71 Crystal lapilli-tuff, on power line at boundary of Bartlett and English Townships, west of Muskrat Lake (Pyke 1978b).

A-1 Talc-chlorite-carbonate rock from west-central bay on Muskrat Lake, northeast English Township. (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

senda Lake in English Township. In central and eastern English Township, this mafic to intermediate metavolcanic sequence is overlain by a thick accumulation of felsic metavolcanics containing subordinate iron formation units. The iron formation, near Muskrat Lake in English Township, marks the terminating phase of the first volcanic cycle in the northwestern part of the area. In Semple Township, the lithological distribution of the mafic to felsic metavolanics in this first volcanic cycle is poorly known because of the lack of bedrock exposure, the tightly folded nature of the strata, and the presence of numerous major faults.

The basal part of this lower mafic to intermediate metavolcanic sequence has been engulfed by the adjacent Peterlong Lake Complex and the younger Moher Pluton. In the metamorphic aureole of these granitic plutons, the amphibolitized metavolcanics are well-foliated and locally gneissic. Epidote-rich lenses and stringers are common in the amphibolites exposed along the east shore of Peterlong Lake and the west shore of Kapiskong Lake. Mineral assemblages in the metamorphic aureole of the Peterlong Lake Complex in Beemer and Moher Townships are indicative of the amphibolite facies of regional metamorphism (as defined by Turner and Verhoogen 1960). The metavolcanics consist mainly of subhedral laths of plagioclase (oligoclase to andesine) and pale green to blue-green hornblende set in a finer grained matrix of epidote, chlorite, biotite and quartz. In contrast, an amphibolite taken from the narrower contact aureole of the Moher Pluton in southwestern English Township contained an oligoclase-hornblende-biotite-garnet mineral assemblage, indicative of the hornblende hornfels facies of contact metamorphism.

A younger sequence of mafic to intermediate metavolcanics underlies most of Zavitz Township. This isoclinally folded sequence overlies the felsic metavolcanics exposed to the west in English Township and forms the major part of a second volcanic cycle in the northeastern part of the area. This mafic to intermediate metavolcanic sequence characteristically consists of interlayered actinolite-bearing and subordinate tremolite-bearing massive to pillowed flows. These metavolcanics in the contact aureole of the Geikie Pluton in northern Zavitz Township contain albite co-existing with epidote; a mineral assemblage indicative of the low grade albite-epidote hornfels facies of contact metamorphism.

Stratigraphically this younger sequence can be subdivided into three sections. The lower section, approximately 900 to 1200 m thick, consists mainly of amygdaloidal, massive to pillowed, actinolitic flows containing minor interflow units of tuff and lapilli-tuff of similar composition. Minor ultramafic flows and Mg-rich (tremolitic) mafic metavolcanics are locally abundant at the base of this lower section between Muskrat Lake in northeastern English Township and Forks Lake in northwestern Zavitz Township. Many of the light grey-green tremolitic metavolcanics in this particular area as well as some to the north of Steve Lake in southeastern English Township were originally mapped as intermediate to felsic (andesitic to dacitic) metavolcanics.

The middle section of this sequence consists entirely of rusty brown weathering, black, variolitic, basaltic flows which form a prominent stratigraphic marker horizon in Zavitz Township. The fold pattern and general outcrop distribution of this 300 to 700 m thick marker horizon, particularly south of Kitchiming and Steve Lakes (units 1b, c and d on maps, back pocket) are sharply delineated on Aeromagnetic Map 291G (G.S.C. 1970). Individual flow units are pillowed and variolitic, flow-top breccias are common, and flow thicknesses vary from 3 to 15 m. Most of the thicker flows have a medium- to coarse-grained centre that grades upwards into variolitic pillow lava. A few amygdules, filled with calcite, chlorite, and epidote, are often present in the variolitic outer margins of the pillows. Some of the thinner flows have a 0.6 to 1.5 m thick central zone of finely banded variolitic lava separating the narrow chilled base from the variolitic pillow top.

The upper section of this sequence is approximately 760 to 1200 m thick. It

consists mainly of dark green actinolitic, massive and pillowed flows containing subordinate interlayered units of light grey-green tremolitic metavolcanics. Massive flow units have amygdaloidal tops, less commonly flow-tops may be variolitic and brecciated. Pillowed flows are commonly amygdaloidal and locally variolitic; pillow breccias are common and many of the thicker pillowed flows have medium- to coarse-grained flow centers. Near the base of the upper section, on the J. Helpert property south of Kitchiming Lake, massive to banded chert, containing disseminated pyrite, pyrrhotite, and chalcopyrite was observed in several places filling primary hollows between pillows. Along Zavitz Creek in the central part of Zavitz Township, Pyke (1974) observed two occurrences of dark green, pyroxene spinifex-textured metavolcanics. These magnesium-rich mafic to ultramafic flows, one of which is 9 m thick are intercalated with the more abundant actinolitic metavolcanics in the lower part of the upper section.

A third major sequence of mafic to intermediate metavolcanics underlies most of the central and southern part of Hutt Township, as well as southeastern Semple Township. The sequence ranges in thickness from approximately 900 m near the northwestern corner of Hutt Township to a maximum of about 2400 m in the southwestern part of the township. Tremolitic and actinolitic metavolcanics are equally abundant. The tremolitic metavolcanics are typically light grey-green, amygdaloidal, massive to pillowed flows that weather light grey to locally buff-brown. Flows commonly contain plagioclase phenocrysts. Pillows are commonly elliptical- to mattress-shaped and range in length from 0.6 m to 1.5 m. Flow-top breccias and interflow tuffaceous units are rare. The tremolitic metavolcanics which are well-exposed along the power line to the northwest and southwest of Canoeshed Lake were largely mapped as intermediate to felsic (andesitic to dacitic) metavolcanics and accordingly are coded 3e, g, and b on Map 2291 (back pocket). Similarly, the light grey-green, massive to pillowed flows near Wellington, Montrose, Jeff, and Junction Lakes in eastern Hutt Township were also classified as andesitic to dacitic rocks (units 3e and 3b on Map 2291, back pocket) rather than tremolite-rich, basaltic to andesitic metavolcanics. Chemical analysis of a tremolitic mafic metavolcanic of tholeiitic affinity is given in Table 2 (Sample No. P-292-72).

The actinolitic metavolcanics are dark grey and green to black on fresh surfaces. Dark grey and green varieties form interlayered amygdaloidal, pillowed flows and fine- to coarse-grained massive flows. Both flow types commonly contain plagioclase phenocrysts. Minor units of mafic to intermediate tuff and agglomerate are locally abundant south of English Lake and north of Foy Lake in northeast Semple Township. Black, fine- to coarse-grained, massive, basaltic flows form a prominent stratigraphic marker horizon across the east-central and southwestern parts of Hutt Township. Although this marker horizon is offset by several major faults, its fold pattern and general outcrop distribution is well-delineated on Aereomagnetic Map 291G (G.S.C. 1970). Pillows and variolites are rare in this marker horizon, a marked contrast with the black basaltic marker horizon previously descibed to the north in Zavitz Township.

The stratigraphic relationship of the mafic to intermediate metavolcanics in Semple and Hutt Townships with the mafic to intermediate metavolcanic sequences in the northern part of the map area cannot be firmly established. In northern Hutt Township, the faulted and tightly folded mafic to intermediate

metavolcanics are intercalated with a sequence of felsic metavolcanics which appears to correlate with the felsic metavolcanics in English Township, the terminating phase of the first volcanic cycle in the northern part of the map area. The felsic metavolcanics in the southeastern corner of Hutt Township stratigraphically overlie the mafic to intermediate metavolcanics. The northward thinning of the mafic to intermediate metavolcanics in Hutt Township, suggests a source area to the south, possibly the Halliday Dome (Bright 1970).

Ultramafic Metavolcanics

The extrusive character of some of the serpentinized ultramafic rocks in English and Zavitz Townships was not at first recognized during the original field mapping. All Early Precambrian rocks having an ultramafic to mafic composition were assigned an intrusive origin and accordingly were coded 4a to d on Maps 2289, 2290 and 2291 (back pocket). The presence in the map area of spinifex-textured ultramafic flows and associated Mg-rich mafic metavolcanics was first reported by Pyke (1978a) during a regional geological survey of the Peterlong Lake area.

Black to greenish black, rusty brown weathering ultramafic metavolcanics outcrop sporadically along the west side and to the south of Muskrat Lake in the northwestern corner of English Township. This ultramafic unit directly overlies felsic metavolcanics and forms the base of a second volcanic cycle in the northern part of the map area. From the north boundary of English Township where the maximum thickness is about 370 m, this ultramafic unit strikes south for 3.2 km and thins rapidly to less than 30 m. The southern extension of the unit has probably been faulted off by the northwest-trending fault south of Muskrat Lake. The eastern (upper) contact of this unit with overlying mafic to intermediate metavolcanics is concealed beneath Muskrat Lake. The sheared and carbonatized nature of the ultramafic rocks on the west shore of Muskrat Lake suggests the presence under the lake of a north-trending fault zone along the upper contact of this unit.

The Muskrat Lake ultramafic rocks are predominately massive, serpentinized and locally carbonatized; spinifex-texture peridotite is locally preserved in some outcrops near the southwest shore of the lake. At the Texmont Mine, located 8 km to the north in Bartlett Township, the ultramafic rocks in the basal portion of this same stratigraphic unit are also massive; no direct evidence for a flow origin has been found, although irregular discontinuous spinifex zones occur locally (Pyke 1978b). Eckstrand (1972) and Pyke (1978b) suggest that the massive basal portion of this ultramafic unit could be interpreted as one or more thick flows, or alternatively, penecontemporaneous high-level subvolcanic sills emplaced along the basal contact of the ultramafic flows. In English Township, metagabbroic dikes and sills cut the felsic metavolcanics which underlie the ultramafic unit; however, no definite cross-cutting relationship between these mafic dikes and the poorly exposed ultramafic rocks was observed. At one contact exposure, a locally carbonatized metagabbro occurs as a sharply bounded sill between iron formation and the overlying highly carbonatized ultramafic rocks. Some of these mafic dikes may have acted as feeder-zones for the upper cycle of mafic to intermediate metavolcanics in Zavitz Township.

Thin section analysis of two samples collected in 1957 by Dominion Gulf Company[1] from an outcrop on the west central bay of Muskrat Lake gave the following composition: tremolite 20 to 50 percent, average 35 percent; chlorite average 30 percent; talc 18 to 40 percent, average 29 percent; carbonate 2 to 10 percent, average 6 percent; and minor to trace amounts of magnetite, leucoxene and limonite. A third sample taken from a more carbonatized part of the same outcrop, gave the following composition: talc 30 percent; chlorite 30 percent; carbonate 25 percent; tremolite 10 percent; and quartz 15 percent. A chemical analysis (Sample No. A-1 in Table 2 from the same location) indicates a high-Mg basaltic composition, whereas analysis of samples taken from this same map-unit to the north in Bartlett and Geikie Townships (Pyke 1978a) indicate an ultramafic composition.

Pyke (1978a) reported occurrences of pyroxene spinifex-textured, ultramafic to mafic metavolcanic flows at several other localities within the map area: (1) on the power line in southeast English Township, immediately south of the large northeast-trending diabase dike; (2) on the Vipond and Heard occurrence (property No.18), along Zavitz Creek in southwest Zavitz Township; and (3) due east of the Robinson occurrence (property No. 16), to the north of Moray Lake in southeast Zavitz Township.

Felsic Metavolcanics

Felsic metavolcanics consisting mainly of tuff, crystal-tuff, and lapilli-tuff, with lesser amounts of tuff-breccia, flow-breccia, and agglomerate form thick sequences in three separate parts of the map area: the largest sequence underlies most of English Township and an undetermined portion of the esker sand-covered northern part of Semple Township; a second sequence underlies the northern part of Hutt Township and the southwestern part of Zavitz Township; and the third and smallest sequence underlies the southeast corner of Hutt Township. Weathered surfaces are generally light grey to green and locally cream, and buff-brown to rusty brown. Fresh surfaces are generally light to medium grey and green, and locally pink and dark grey to black. Local shearing has transformed some of these rocks into light green sericite schist and grey-green chlorite-sericite schist.

The largest felsic metavolcanic sequence which underlies most of English Township and parts of western and northern Semple Township is approximately 4600 to 7600 m thick. Thin units of lean, magnetite-chert iron formation are locally abundant near the top and in the central part of this felsic metavolcanic sequence which marks the terminating phase of the first volcanic cycle in the northern part of the map area. In English Township, the felsic metavolcanics are mainly massive-looking, fine-grained tuff and thickly bedded (a few metres) coarse-grained crystal-tuff. Minor units of well-bedded tuff and lapilli-tuff occur: (1) adjacent to and interlayered with units of iron formation; and (2) interlayered with massive, fine-grained felsic tuff on Muskasenda Lake. Graded bedding and load cast structures are well-preserved in several of

[1]Resident Geologists' Files, Ontario Ministry of Natural Resources, Kirkland Lake.

the tuff and lapilli-tuff units exposed on the islands in Muskasenda Lake. In several places between Muskasenda and Muskrat Lakes in English Township, massive, fine-grained tuffs grade upward and laterally into crystal-lapilli-tuff and lapilli-tuff; less commonly they grade into tuff-breccia and agglomerate. The tuffs which often contain plagioclase and quartz phenocryts, are essentially composed of sodic plagioclase fragments set in a fine-grained matrix of feldspar, quartz, sericite, and chlorite. Most of the fragments in the lapilli-tuff and tuff-breccia are lighter coloured than the enclosing matrix, but similar in texture and composition. The chemical analysis of a dacitic crystal-lapilli-tuff exposed on the power line, a short distance north of the northern boundary of English Township is given in Table 2 (Sample No. P-27-71).

Tuff-breccia, with minor lapilli-tuff and agglomerate layers is well-exposed over a 3.2 km strike length along the power line west of Muskrat Lake. The unit thickens from less than 30 m near the northern boundary of English Township to more than 240 m along strike to the south. The tuff-breccia consists of light grey to buff brown weathering fragments of dacitic tuff set in a medium grey weathering, fine-grained, tuffaceous matrix of similar composition. Plagioclase phenocrysts up to 2 mm maximum dimension are common in the matrix and in many of the dacitic fragments. The fragments are angular to subrounded, range in diameter from 5 to 30 cm, and average between 40 to 80 percent of the rock. This tuff-breccia unit gradationally overlies a massive-looking unit of porphyritic tuff to crystal-tuff, and in turn is overlain by a unit of chert-magnetite iron formation. In places along the contact with the iron formation, the matrix of the tuff-breccia contains patches of disseminated to massive magnetite.

A tightly folded and cross-faulted sequence of felsic metavolcanics underlies parts of northeastern Semple Township, northern Hutt Township, and southeastern Zavitz Township. The sequence consists mainly of massive-looking fine-grained tuff and subordinate crystal-tuff and lapilli-tuff. Fine-grained tuff containing quartz phenocrysts is locally abundant along Zavitz, Dexter, and Wellington Creeks in Hutt Township. In the large outcrop exposure located about 600 m south-southeast of Luke Lake in northern Hutt Township, massive-looking, fine-grained rhyolitic tuff containing quartz phenocrysts grades upwards into crystal-tuff and lapilli-tuff containing abundant potassic feldspar fragments. West of Canoeshed Lake in western Hutt Township, finely bedded felsic tuff forms a 370 m thick unit in the core of an easterly plunging anticline. This unit characteristically consists of interlayered light grey to cream, fine-grained to cherty felsic layers, 0.5 to 30 cm thick, and thinner, medium to dark green chloritic layers of a more intermediate composition. This map unit may be in part a tuff-derived metasediment.

Several good exposures of tuff-breccia (and possibly some flow-breccia) occur along Wick's lumber road south of English Lake and east of Luke Lake. The breccias consist of light to dark grey and green, and occasionally pink and creamy white felsic fragments set in a light to medium grey weathering matrix of similar composition. Fragments are angular to subrounded, often elongated, and range in size from 5 to 25 cm; large angular fragments, up to 60 cm in length occur in the breccia near Luke Lake.

This felsic pyroclastic sequence appears to be more rhyolitic in composition than the dacitic pyroclastic sequence which underlies English Township; fur-

thermore, pyrite-bearing graphitic tuff horizons are locally intercalated with the felsic pyroclastic rocks in Hutt and Zavitz Township, however magnetite-chert iron formation units are absent.

The third major sequence of felsic metavolcanics, approximately 1600 m thick, occurs in the southeastern corner of the map area, between Hutt Lake and the eastern branch of the Grassy River. These felsic metavolcanics form the northern extent of a major sequence of intermediate to felsic metavolcanics which underlie most of northeastern Halliday Township, immediately to the south (Bright 1970).

On Hutt Lake, the felsic metavolcanics consist mainly of interlayered tuff-breccia, lapilli-tuff, and agglomerate. Subordinate units of massive to banded, fine-grained felsic tuff and minor intermediate flows and tuffs are intercalated with the more abundant coarser pyroclastics. The matrix of the coarser pyroclastics varies from a light grey weathering felsic tuff to a more chloritic, grey-green to dark green intermediate tuff. The fragments vary in shape from subrounded to subangular and range up to 0.9 m in diameter. Massive, light grey to green rhyodacitic fragments predominate in the felsic breccia; other fragments include massive and flow-banded, pink to creamy white rhyolitic, massive light grey dacitic tuff, and irregular aggregates of vein quartz. The felsic to intermediate breccia contains predominately dacitic fragments, with subordinate amounts of mafic to intermediate fragments.

Conglomerate

A small outlier of polymictic volcanoclastic conglomerate, containing minor discontinuous interbeds of tuffaceous siltstone and graphitic slate (unit 3h on Map 2290, back pocket) occurs to the east of West Nighthawk Lake, near the eastern boundary of Zavitz Township. The contact relationship of this conglomerate unit with the underlying mafic to intermediate metavolcanics is uncertain. The discordant attitude of observed bedding features with respect to the regional trend suggests some degree of disconformity with the surrounding strata.

This grey-green polymictic conglomerate consists of subangular to rounded clasts of felsic and mafic metavolcanics, cherty rhyolite, quartz-feldspar porphyry, serpentinized peridotite, medium-grained gabbro, and vein-quartz set in a dark green greywacke-type matrix. Clasts average between 40 and 60 percent of the rock and range from 1 to 5 cm in diameter. Disseminated pyrite and pyrrhotite are common in the matrix and where present produce a buff-brown to rusty brown weathered surface.

Iron Formation

Iron formation is restricted to the felsic metavolcanic sequence in English and Semple Townships. These metavolcanics mark the terminating phase of the first volcanic cycle in the northwestern part of the map area. Iron formation

occurs at two stratigraphic intervals within the felsic metavolcanics. A lower unit of interbedded oxide- and sulphide-facies iron formation occurs in the central part of the sequence, and an upper unit of predominately oxide-facies iron formation lies near the top of the sequence. Individual iron formation units range in thickness from several centimetres to 60 m, but most are less than 9 m; the thickest oxide-facies iron formation unit occurs west of Muskrat Lake at the top of the felsic metavolcanic sequence.

The lower oxide-and-sulphide iron formation unit outcrops sporadically in north-central, central and southeastern English Township, and near Little Redstone Lake in northwestern Semple Township. The trace of this discontinuous iron formation horizon beneath the esker sand-covered portions of English and Semple Townships is shown on Aeromagnetic Map 291G (G.S.C. 1970). Oxide-facies iron formation generally consists of alternating black magnetite-rich layers (usually less than 1 cm in thickness) and light grey to reddish brown chert layers. Disseminated magnetite also occurs in tuff, tuff-breccia and chert-breccia units intercalated with the magnetite-rich layers. Sulphide-facies iron formation consists of disseminated grains and stringers of pyrrhotite and pyrite in thinly bedded chert, in massive to thinly bedded felsic tuff, and in the matrix and fragments of associated units of chert-breccia and felsic breccia. Most exposures consist of several 0.3 to 3 m thick units of thinly interbedded oxide- and sulphide-facies iron formation that intercalate with, or grade laterally into, thicker units of tuff and breccia containing disseminated pyrrhotite, pyrite, and magnetite. The associated tuff and breccia at the Hollinger occurrence (number 9 on Map 2290, back pocket) and the Spirit Lake Mines Limited property (number 29 on Map 2291, back pocket) locally contain as much as 10 percent magnetite-minor pyrrhotite and between 3 and 15 percent pyrrhotite-pyrite-trace chalcopyrite.

In the southwestern corner of English Township, the lower iron formation unit lies within the contact metamorphic aureole of the Moher Pluton. The iron formation has been recrystallized to a light grey, medium-grained layered rock which consists of 5 to 20 percent granular magnetite set in a coarse-grained groundmass of plagioclase, quartz, and minor hornblende, biotite, and garnet. Alternating thin magnetite-rich layers and thicker (up to 20 cm) magnetite-poor layers reflect the original bedded nature of the iron formation. A selected sample, collected by the author, contained 20.7 percent Fe and 1.72 percent TiO_2 (analysis by the Geoscience Laboratories, Ontario Geological Survey, Toronto).

The upper oxide-facies iron formation unit trends north along the west side of Muskrat Lake and ranges in thickness from 9 to 60 m over a continuous strike length of about 2400 m. To the west, the iron formation gradationally overlies dacitic lapilli-tuff to tuff-breccia. From the north boundary of English Township to the northwest-trending olivine diabase dike on the power line, 900 m to the south, the iron formation unit consists of two closely spaced bands intercalated with dacitic tuff and tuff-breccia. Both bands average about 12 m in thickness and consist of alternating, 0.2 mm to 5 cm thick black, magnetite-rich layers and light grey chert layers. Minor disseminated pyrrhotite and pyrite are present in some chert layers.

South of the olivine diabase dike, the iron formation becomes a single band that pinches and swells between 15 and 60 m in thickness, for an additional strike length of about 1500 m. This section of the iron formation band occurs at

the top of the felsic metavolcanic sequence and is immediately overlain by a unit of serpentinized ultramafic metavolcanics. In the wider parts of this southern section of iron formation, magnetite-rich layers are thicker (up to 9 m) and more abundant in the lower part of the band. In many places along the base of the iron formation, the underlying dacitic pyroclastics grade upward into a zone of magnetite-rich breccia; the enclosed dacitic fragments decrease rapidly from about 90 percent of the rock by volume to less than 5 percent across a unit which ranges from 0.6 to 4.6 m in thickness. A selected sample of the matrix of a magnetite-rich breccia located about 600 m south of Muskrat Lake contained 30.8 percent Fe and 0.3 percent TiO_2 (analysis by the Geoscience Laboratories, Ontario Geological Survey, Toronto).

Narrow, discontinuous lenses of oxide-facies iron formation containing minor interbeds of pyritic tuff and chert occur near the top of this same sequence of felsic metavolcanics in the southeastern corner of English Township and the adjoining northeastern corner of Semple Township. The widest lens observed, about 12 m in thickness occurs on the power line immediately north of the large northeast-trending quartz diabase dike. This thinly bedded magnetite-chert iron formation unit grades upward into a felsic tuff-breccia, the matrix of which contains disseminated magnetite and minor pyrite. About 400 m south of this lens another narrow unit of oxide-facies iron formation contains several narrow interbeds of green carbonate-rich rock cut by small, pyrite-bearing quartz veins and stringers.

METAMORPHOSED MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

Mafic and ultramafic intrusive rocks which predate regional metamorphism and folding intrude the metavolcanic-metasedimentary sequences and are themselves intruded by late tectonic intermediate to felsic dikes and by diabase dikes. They occur predominately as: (1) mafic sills, dikes, and irregularly shaped intrusions within intermediate to felsic metavolcanics; (2) differentiated ultramafic to mafic sills in mafic to intermediate metavolcanics; and (3) discrete ultramafic sills in intermediate to felsic metavolcanics.

Mafic Sills, Dikes, and Irregularly Shaped Intrusions

Mafic intrusive rocks, consisting of gabbro, quartz gabbro and minor diorite occur mainly within the mafic to felsic metavolcanic cycle in the northern part of the map area. Metamorphosed gabbro, the dominant rock type present, forms the major phase in the large Muskasenda Lake layered sill complex which was emplaced along the contact between the lower mafic to intermediate metavolcanics and the overlying intermediate to felsic metavolcanics, in western English Township. Gabbro also forms numerous small sills and in places dikes and irregularly shaped intrusions near the stratigraphic top of the intermediate to felsic metavolcanics in eastern English Township and in the mafic to intermediate metavolcanics north of Kitchiming Lake in northeastern Za-

vitz Township. Most of the smaller, generally concordant gabbro sills range in thickness from 30 to 610 m. Quartz gabbro forms subordinate phases in the Muskasenda Lake layered sill and in some of the smaller discrete sills. These bodies, particularly the Muskasenda Lake gabbroic sill, are cut by comagmatic fine-grained dikes of gabbro, quartz gabbro, and diorite; both the dikes and the host rock have been metamorphosed under greenschist facies conditions.

The southern part of the Muskasenda Lake layered gabbroic sill, a large regional intrusion, is exposed in northwestern English Township. This portion of the sill complex is a multiple intrusion composed of two major sills separated for the most part by narrow screens of metavolcanics exposed along the central part of Muskasenda Lake. The lower sill, exposed along the west and south shores of Muskasenda Lake, has a broad compositional zoning consisting of: (1) a basal zone of gabbro; (2) a central zone of gabbro with subordinate interlayers of quartz gabbro; and (3) an upper zone of quartz gabbro, with local phases of granophyric gabbro near the top of the intrusion. Pyke (1978b) reported a few outcrops of pyroxenite near the base of the intrusion in Bartlett Township, immediately north of the map area. Individual layers in the gabbro-quartz gabbro zone range in thickness from 30 to 90 m. Small scale layering, with individual layers ranging from 2.5 to 60 cm in thickness, is best exposed in the gabbro along the south shore and on adjacent islands in Muskasenda Lake. The upper sill, exposed along the east shore of the lake, is mainly gabbro. Compositional zoning was not found, although small scale layering in the gabbro near the top of the sill was observed on several small islands near the southeast shore of Muskasenda Lake. The sill complex has an average total thickness of about 1500 m along an exposed strike length of 6.4 km; it extends at least another 11.2 km to the north, beyond the boundary of the map area.

Gabbro and subordinate quartz gabbro, the main mafic intrusive phases, are typically massive, medium-grained rocks that range in colour from light grey-green to dark green and locally black. Weathered surfaces are light to dark grey. Most of the gabbro is equigranular and has an ophitic to subophitic texture; however, some of the gabbro in the layered sill exposed on the south shore of Muskasenda Lake contains 0.5 to 4 cm subrounded clots of ophitic gabbro set in a finer grained ophitic matrix of similar composition. Differential weathering produces a nodular pattern on the exposed surfaces of these rocks.

Blue quartz grains up to 3 mm in diameter are diagnostic constituents of the quartz gabbro and granophyric gabbro phases in the Muskasenda Lake layered sill. Similar blue quartz gabbro forms local phases in some of the irregularly shaped discordant gabbro intrusions on the power line west of Muskrat Lake. Most of the blue quartz gabbros and granophyric gabbros are moderately to strongly magnetic in hand specimen.

The gabbro consists of 40 to 60 percent amphibole, 35 to 50 percent altered plagioclase, 2 to 10 percent titaniferous magnetite, and as much as 10 percent quartz. The primary pyroxene and hornblende are completely altered to anhedral to fibrous aggregates of pale green to bluish green amphibole, green chlorite, and iron minerals. The primary plagioclase is largely altered to clinozoisite, subordinate epidote and sodic plagioclase, and minor chlorite and calcite. Colorless to dark blue quartz forms: (1) minor interstitial grains in gabbro; (2) up to 10 percent combined interstitial grains and myrmekitic intergrowths in quartz gabbro; and (3) in places, up to 5 percent micrographic intergrowths of

quartz and potash feldspar in granophyric gabbro. Quartz gabbro and granophyric gabbro contain between 5 and 10 percent titaniferous magnetite; gabbro generally contains less than 5 percent.

The Muskasenda Lake layered sill is cut by late tectonic dikes of diabase, quartz-feldspar porphyry, aplite, fine-grained granite to diorite, and numerous veins and stockworks of quartz and epidote. Two small, flat-lying, irregularly shaped granite-pebble lamprophyre dikes intrude the gabbro on the islands near the south end of Muskasenda Lake. These flat-lying, discontinuous patches of granite-pebble lamprophyre were misidentified in the field and are not basal remnants of Gowganda Formation conglomerate (unit 8a) as shown on Map 2290 (back pocket).

Ultramafic to Mafic Sills

Ultramafic to mafic sills intrude the mafic to intermediate metavolcanics in southeastern Semple Township. Serpentinized ultramafic rocks, derived mainly from peridotite and in places pyroxenite, are the most common rock types present. They form major phases in two large, differentiated sills and local phases in some of the smaller irregular to lens-shaped masses in the immediate vicinity of the larger sills. Gabbro and diorite form subordinate phases in the differentiated sills, and major phases in many of the smaller related satellitic bodies.

The serpentinized ultramafics are massive, fine- to medium-grained, magnetic rocks that are commonly dark grey to blue-grey and dark green on fresh surfaces but locally may be mottled greenish grey to black. The soft weathered surface is light grey and green or brownish green to rusty brown. Grey to black serpentinized peridotite is composed largely of serpentine, chlorite, and tremolite, with variable but minor amounts of iron oxide and carbonate. Brownish green serpentinized pyroxenite consists mainly of tremolite-actinolite, with subordinate amounts of serpentine minerals, chlorite, and carbonate. Contacts between massive, medium- to coarse-grained gabbro and diorite are gradational. The gabbro is a grey-green to dark green rock composed mainly of dark green to black amphibole and subordinate light greenish white feldspar. The diorite is a light greenish grey to medium grey rock consisting mainly of white feldspar and subordinate black amphibole; local coarse-grained pegmatitic phases in the diorite contain up to 80 percent white feldspar.

The two large ultramafic to mafic differentiated sills are described below:

The first major sill is located about 610 m south of Foy Lake in eastern Semple Township. It is folded about a local east-trending synclinal axis and is terminated by faults at its eastern and western ends. On the south limb of the syncline, the sill ranges in thickness from 61 to 396 m. It consists of a 61 to 213 m thick basal layer of peridotite, a 15 to 61 m thick middle layer of pyroxenite and gabbro, and an upper 61 to 122 m thick section consisting of diorite with local gabbroic phases. The gabbro forms a gradational phase between the diorite to the north and the pyroxenite to the south. The pyroxenite has a sharp contact with the underlying peridotite and forms a 15 to 46 m thick continuous layer over the exposed length of the sill. A peridotite dike emanating from the

basal unit appears to cut the pyroxenite, gabbro and diorite. On the north limb of the syncline, the sill is only about 76 m thick and consists mainly of diorite with minor gabbroic phases.

The second sill is the poorly exposed, crescent-shaped intrusion located east of Parting Lake in south-central Semple Township. The sill is folded about a local east-plunging anticlinal axis and varies in thickness from 488 m on the nose of the fold to 91 m on the limbs. It appears to consist mainly of serpentinized ultramafic rocks. Diamond-drill holes put down on both limbs of the fold intersected gabbro at the base of the sill; however, in holes put down on the nose of the fold, serpentinized ultramafic rocks were encountered at the base of the sill.

Ultramafic Sills

Light grey and green to rusty brown weathering serpentinized peridotite and subordinate pyroxenite form small, discrete, lenticular, sill-like bodies, ranging from 15 to 122 m in thickness, near the east-central boundary of the map area. They occur: (1) in the felsic pyroclastic rocks between Luke and Moray Lakes; and (2) in the finely bedded felsic tuff (or tuff-derived metasediment) west of Canoeshed Lake. Some of the thicker sills contain local phases of fine- to medium-grained gabbro. Although a small, spinifex-textured, peridotite zone occurs on the eastern peninsula in Moray Lake, the ultramafic rocks are typically fine-grained and massive; no positive evidence for a flow origin was observed. These ultramafic rocks, particularly those near Moray Lake, may represent high-level subvolcanic intrusive equivalents of the ultramafic metavolcanics in the overlying mafic to intermediate volcanic rocks in Zavitz Township.

FELSIC INTRUSIVE AND METAMORPHIC ROCKS

Early Granitic Rocks

Early granitic intrusive rocks consist of (gneissic) quartz monzonite, granodiorite, quartz diorite, diorite, and related hybrid granitic to dioritic rocks. Most of these rocks occur as foliated phases in the Peterlong Lake Complex which underlies western Beemer and Moher Townships. In this report, the Peterlong Lake Complex refers only to the foliated northeastern margin of a large granitic batholith that underlies several hundreds of square kilometres to the west of the map area. The amphibolitic metavolcanics close to the contact with the Peterlong Lake Complex are intruded by numerous related dikes of fine- to medium-grained quartz diorite to diorite, and locally coarse-grained to pegmatitic granodiorite and pink felsite; quartz veins and epidotite-rich lenses and stringers are also common. Massive, medium-grained porphyritic diorite, diorite, and quartz diorite also form several small (up to 1 km in length), related lens-shaped intrusive masses near the top of the mafic to intermediate metavolcanic sequence in northeastern Beemer Township.

PETERLONG LAKE COMPLEX

The Peterlong Lake Complex in Beemer and Moher Townships is composed mainly of medium- to coarse-grained, pinkish grey to grey biotite-hornblende granodiorite, with subordinate gradational phases of pink quartz monzonite and grey, quartz-rich granodiorite. These light grey weathering granitic rocks are locally porphyritic, and in general are weakly to strongly foliated; the foliation becomes progressively more pronounced toward the contact with the metavolcanics. The general composition of the granodiorite is 45 to 60 percent plagioclase, 10 to 20 percent microcline, 15 to 25 percent quartz, and 3 to 10 percent combined hornblende and biotite. Subhedral to euhedral plagioclase laths are usually unzoned and contain abundant inclusions of subrounded quartz; the composition ranges from sodic oligoclase to calcic-oligoclase (An_{15}-An_{30}). Anhedral quartz and subhedral, weakly perthitic microcline are mainly interstitial to the plagioclase. Quartz ranges up to 35 percent in quartz-rich granodiorite phases, and microcline ranges up to 40 percent in quartz monzonite phases of the granodiorite.

Close to the contact with the amphibolitized mafic metavolcanics, grey gneissic granodiorite with abundant xenoliths grades into grey gneissic hornblende diorite and quartz diorite. Agmatitic diorite breccia occurs locally at the contact with the metavolcanics along Peterlong Lake in central Beemer Township. It consists of angular to lenticular blocks of amphibolite and gneissic metadiorite, up to 0.9 m in diameter, in a matrix of weakly foliated hornblende diorite. A typical diorite contains 50 to 60 percent plagioclase (andesine), 25 to 40 percent prismatic to subhedral dark brown hornblende, minor amounts of biotite and quartz, and occasionally microcline.

Dikes of diorite and quartz diorite intrude the hybrid granodioritic to dioritic rocks near the contact; however, only a few dikes of aplite and pegmatite were observed to cut the main body of granodiorite west of Peterlong and Kapiskong Lakes.

Late Granitic Rocks

Late granitic intrusive rocks include: (1) the Moher Pluton, a large body of quartz monzonite and granite in the western part of the map area; and (2) the southwest margin of the granodioritic Geikie Pluton in the northwestern corner of Zavitz Township. Small epizonal stocks and related dikes of granodiorite and syenite, possibly genetically related to the Geikie Pluton, occur near West Nighthawk Lake in southeastern Zavitz Township.

Late dikes of quartz-feldspar porphyry, aplite, felsite, and minor fine-grained granite-diorite and lamprophyre occur mainly in the northern part of the map area; they are particularly abundant in the vicinity of the larger, late granitic plutons described below.

MOHER PLUTON AND RELATED EPIZONAL DIKES

The granitic rocks of the Moher Pluton are predominately medium-grained, porphyritic, pink biotite quartz monzonite and minor granite. The entire pluton was originally classified as granite; however, the ratio of potash feldspar to total feldspar only exceeds two-thirds locally, in the central portions of the pluton. Leucocratic phases, in which biotite is rare or absent, were classified as alaskite in the field.

The pluton, which underlies southeastern Beemer Township and all but the northwestern corner of Moher Township, intrudes the western margin of the metavolcanic-metasedimentary belt and the eastern margin of the Peterlong Lake Complex. Contacts with the metavolcanics are generally sharp and xenoliths are not common; some wall rock assimilation has enriched the contact zone in hornblende and biotite. For the most part, the Moher Pluton is spatially separated from the Peterlong Lake Complex, either by faults or by narrow screens of amphibolite. In the map area, the Moher Pluton has an exposed strike length of about 14.5 km but extends well beyond the southern boundary of Moher Township. Its northeast end, located in southeastern Beemer Township, is about 4.8 km wide. Most of the western part of the pluton has been displaced more than 6.4 km to the south by a major north-trending fault running through Kapiskong and Peterlong Lakes. Within a few hundred feet of the contact, the foliation disappears, the rock is medium-grained, hornblende is absent, biotite averages about 1 percent, and both albite and microcline form phenocrysts.

The central part of the pluton, exposed along the shores of Kapiskong Lake, contains little or no biotite. In general, the composition of the quartz monzonite is 30 to 45 percent plagioclase (albite), 25 to 40 percent microcline, 20 to 25 percent quartz, and about 1 percent biotite. Locally, medium- to coarse-grained porphyritic quartz monzonite grades into granite containing abundant microcline phenocrysts up to 2 cm in length. In general the composition of the quartz monzonite is 30 to 45 percent plagioclase (albite), 25 to 40 percent microcline, 20 to 25 percent quartz and about 1 percent biotite.

Foliated, fine- to medium-grained, porphyritic biotite quartz monzonite forms a sharply bounded chilled zone, 15 to 61 m wide, along the exposed northern and eastern contacts of the pluton. Near the contact, plagioclase of albite composition forms phenocrysts up to 5 mm in diameter in a finer grained equigranular groundmass of albite, microcline and quartz; the biotite content increases to about 3 percent; minor hornblende is locally present; and quartz forms anhedral grains, subhedral to six-sided crystals, and graphic intergrowths with microcline.

Numerous quartz-feldspar porphyry dikes intrude the metavolcanics along the east shore of Peterlong Lake, close to the northern margin of the Moher Pluton. The dikes weather light grey to pinkish grey and consist of subhedral quartz and albite phenocrysts set in a non-foliated aphanitic matrix of albite, microcline, quartz, and minor biotite. The dikes range in thickness from several centimetres to 45 m and most have a preferred north-south orientation. They are considered to be late offshoots of the Moher Pluton, even though there is an apparent clustering of the dikes near the north-trending fault through Peterlong Lake. Nowhere were similar porphyry dikes observed to cut the older

Peterlong Lake Complex which lies to the west of this fault.

In the vicinity of Muskasenda Lake, the large number of felsic dikes, composed primarily of quartz-feldspar porphyry, and numerous quartz stockworks and veins suggest that an unexposed granitic pluton is present in this area at shallow depth. The northeast end of the Moher Pluton, which is exposed about 1.6 km to the south of Muskasenda Lake, has deformed the previously folded metavolcanics in this region and appears to plunge north beneath Muskasenda Lake. The light grey weathering quartz-feldspar porphyry dikes have a preferred east-west trend and range in width from 1.5 to 91 m. Minor pyrite is locally present, and disseminated chalcopyrite is present along the sheared southern margin of a 76 m wide dike exposed along the north shore of the small west bay on Muskasenda Lake. Gold-bearing quartz veins have been reported from two localities near Muskasenda Lake (*see section on* Economic Geology). Other dikes locally present include aplite, felsite, fine- to medium-grained granite-diorite, and mica lamprophyre.

GEIKIE AND WEST NIGHTHAWK LAKE PLUTONS AND RELATED EPIZONAL DIKES

The southwestern margin of the Geikie Pluton, a large homogeneous mass of light greenish white to pink weathering, medium-grained, porphyritic hornblende granodiorite, underlies a small area in the northwest corner of Zavitz Township. The pluton, centered in Geikie Township to the north of the map area, consists of about 60 percent plagioclase (albite to sodic oligoclase), 17 percent quartz, 16 percent microcline, and 4 percent combined chloritized hornblende and biotite (Pyke 1978b).

The marginal phase of the Geikie Pluton in Zavitz Township has a fairly sharp contact with the metavolcanics, but is highly contaminated and contains numerous partially assimilated amphibolitized metavolcanic xenoliths. The rocks are all foliated and vary from pinkish grey biotite-hornblende granodiorite to more hornblende-rich phases of pink to brownish pink biotite-hornblende syenite and hybrid-syenite along the contacts.

Near West Nighthawk Lake in southeastern Zavitz Township, massive, medium-grained, pinkish grey biotite-hornblende granodiorite with subordinate phases of pink to brownish pink syenite forms an oval-shaped stock measuring about 760 m in length and 370 m in width. Contacts with the metavolcanics are sharp, and marginal phases are fine- to medium-grained and locally porphyritic. Hand specimens of the granodiorite are very similar in appearance to the unfoliated granodiorite of the Geikie Pluton. Thin section examination (point count analysis) showed the granodiorite to consist of about 50 percent plagioclase (oligoclase), 25 percent weakly perthitic microcline, 15 percent quartz, 8 percent hornblende, and 3 percent biotite. Approximately 610 m south of this granodiorite stock is a smaller oval-shaped stock of medium-grained, pink, porphyritic, leucocratic biotite syenite. The metavolcanics in the vicinity of these small stocks are cut by numerous granodiorite, syenite, felsite, and aplite dikes which are probably related to the stocks.

LATE MAFIC INTRUSIVE ROCKS

Diabase

Diabase dikes intrude all previously described major rock types. There are three main diabase dike trends in the Ferrier Lake-Canoeshed Lake area: north-northwest, northeast, and northwest. Although no radiometric dating has been done on these rocks, the diabase dikes have been assigned two distinct ages, Early Precambrian and Middle to Late Precambrian. This two-fold subdivision is based largely on attitude, composition, and inferred cross-cutting relationships within the area. A further basis for correlation was observed age relationships on similarly trending dikes in townships adjacent to the map area (Bright 1970; Pyke 1978a,b).

All the north-northwest-trending diabase dikes have been assigned an Early Precambrian age and are correlated with the regional Matachewan diabase dike swarm described by Fahrig *et al.* (1965) and dated at 2485 m.y. old. This radiometric age (K-Ar determination) was reported by Fahrig and Wanless (1963) from a sample taken in the vicinity of the town of Matachewan, about 45 km east of the map area.

Northward-trending diabase dikes occur throughout the area, but are particularly conspicuous cutting the granitic rocks in Beemer and Moher Townships. Dips are steep to vertical and most dikes are between 6.1 and 30.5 m in width; a few range up to 60 m in width. The dikes have aphanitic chilled margins and medium- to coarse-grained, equigranular, diabasic-textured interiors. The diabase is massive, weathers dark brown to rusty brown, and is dark green to greenish grey on fresh surfaces. Chloritic alteration is usually apparent on fresh surfaces and most samples contain a few visible grains of pyrite. The large, altered, greenish plagioclase phenocrysts which are characteristic of the Matachewan dike swarm to the east of the map area were seldom observed.

Thin section examination (point count analysis) indicated that the rock consists mainly of a felted mass of 50 to 60 percent labradorite laths, with 30 to 45 percent interstitial augite. Most samples contained up to 5 percent quartz and minor primary biotite. Accessory minerals include magnetite, ilmenite, pyrite, and apatite. The plagioclase is invariably saussuritized; most of the augite is largely altered to chloritized uralite and minor biotite; and leucoxene has developed from the ilmenite.

Middle to Late Precambrian (Proterozoic)

HURONIAN SUPERGROUP

Cobalt Group

GOWGANDA FORMATION

Huronian metasediments do not occur in the map area as previously reported (Bright 1968b). Two small, very irregularly shaped, flat-lying granite-pebble lamprophyre dikes exposed on the islands near the southeast shore of Muskasenda Lake in English Township were incorrectly identified on Map 2290 (back pocket) as basal remnants of Gowganda Formation conglomerate. Subsequent thin section examination showed that the chlorite-rich matrix surrounding the rounded granitic pebbles was of igneous rather than sedimentary origin.

MAFIC INTRUSIVE ROCKS

Diabase

NORTHEAST-TRENDING QUARTZ DIABASE DIKES

A large, regional, northeast-trending quartz diabase dike, up to 152 m in thickness, extends across the central part of the map area from southeastern Moher Township, through Semple and English Townships, to northwestern Zavitz Township. On Aeromagnetic Map 291G (G.S.C. 1970), this dike has one of the highest magnetic expressions of any rock type in the area, and as such its location has been fairly accurately determined, both within and beyond the limits of the map area. This quartz diabase dike intrudes the Gowganda Formation of the Huronian Supergroup in Fallon Township, northeast of the map area (Pyke 1973a) and is therefore post-Huronian in age. A second, large, northeast-trending quartz diabase dike, situated on the northwestern shore of Peterlong Lake in northern Beemer Township, and several small dikes of similar trend in northern Zavitz Township were also assigned the same age. In this part of the Superior Province, northeast-trending diabase dikes are correlated with the northeast-trending Abitibi dike swarm described by Fahrig *et al.* (1965). Radiometric ages obtained from dikes assigned to this swarm range from 2147 m.y. (Gates and Hurley 1973) to 1230 m.y. (Fahrig and Wanless 1963).

Ferrier Lake-Canoeshed Lake Area

The large, northeast-trending quartz diabase dike in the center of the map area is massive, ophitic textured throughout, and weathers light to medium greenish grey and locally rusty brown. Fresh surfaces are light greenish grey within the very coarse-grained central part of the dike and dark grey near the aphanitic chilled margin, which in places is up to 7.6 m in width. A pinkish grey, leucocratic phase of the diabase, consisting largely of plagioclase and graphic intergrowths of K-feldspar and quartz, was locally observed in the central portion of the dike. In thin section, the rock has a pronounced ophitic texture throughout; however, plagioclase and augite phenocrysts occur only in the aphanitic chilled margin. The main constituents are 50 to 60 percent labradorite and 25 to 35 percent interstitial augite; minor amounts of interstitial to intergranular quartz, hornblende, and biotite are also present. Accessory magnetite and magnetite-ilmenite intergrowths form partial rims around augite, as well as skeletal intergrowths in augite. The plagioclase is saussuritized to some degree, and most of the augite is partially altered to pale green fibrous amphibole and minor chlorite. The southwestern extension of this dike in Semple and Moher Townships is incorrectly coded on Maps 2291 and 2289, and should be 9b; *not* 9a.

NORTHWEST-TRENDING OLIVINE DIABASE DIKES

All the northwest-trending, predominantly olivine-bearing diabase dikes were assigned a Middle to Late Precambrian age. This group of dikes (which are all incorrectly coded on the maps and should be 9a *rather than* 9b) may be related to the Late Precambrian northwest-trending Sudbury dike swarm of northeastern Ontario, described by Fahrig *et al.* (1965) and dated at 1330 m.y. Cross-cutting relationships between this group and the north-northwest-trending or northeast-trending groups were not observed in the area. A prominent northwest-trending olivine diabase dike is known to intrude the Middle Precambrian Gowganda Formation in Hincks Township, immediately east of Zavitz Township (Pyke 1978b). In Geikie Township, immediately north of Zavitz, inconclusive field evidence suggests that the same dike intrudes the large northeast-trending quartz diabase dike which crosses the entire map area (Pyke 1978a). Pyke (1978b) suggests a Late Precambrian age for the northwest-trending olivine diabase dikes in the region.

The northwest-trending dikes are massive, ophitic-textured, and usually olivine-bearing. They are steeply dipping and most are less than 30 m in width. The diabase is grey-green on the weathered surface and dark greyish green to dark green on the fresh surface. Thin section examination (point count analysis) of the northwest-trending dike which crosses Zavitz Creek in southern Zavitz Township showed the rock to contain about 55 percent labradorite, 25 percent interstitial augite, 15 percent interstitial to intergranular olivine, and up to 5 percent magnetite. Accessory minerals include apatite and biotite, the latter usually associated with magnetite. Most of the primary minerals show very little alteration; the only notable alteration present is minor serpentinization of the olivine and minor uralitzation of the pyroxene.

Cenozoic

QUATERNARY

Pleistocene and Recent

The Ferrier Lake-Canoeshed Lake area is mostly covered by glaciofluvial-glaciolacustrine silts and sands that were deposited along three regional north-trending esker complexes which traverse the area. Glaciolacustrine clay and silt deposits from glacial Lake Barlow-Ojibway, which covered a large part of northeastern Ontario during the Pleistocene Epoch, are absent. The southernmost reported limit of these deposits occurs in McArthur and Douglas Townships, 10 km north of the map area.

The large medial esker complex that traverses English and Semple Townships is more than 80 km in length (Bright 1973) and traces the former path of a major meltwater channel leading from the wasting Wisconsinan ice margin. The stratified silts, sands, and gravels of this segmented and branching esker are flanked by a broad apron of finer-grained silts and sands. In many places, these glaciofluvial sediments are overlain by a thin cover of glaciolacustrine silt and silty fine sand. In northern English Township, the esker is a single, narrow, sinuous ridge with steeply sloping sides, and a very broad flanking apron of finer-grained sands. Further south in Semple Township, it becomes a series of broader-topped subparallel segments that branch and rejoin, and enclose numerous kettle depressions. During an arid postglacial period, northwesterly winds crossing the sand-covered areas in Semple and eastern Moher Townships redeposited some of the sand in dune form.

The large esker complex in the central part of the area is flanked on the west and east by smaller subsidiary esker trains. To the west, in Beemer and Moher Townships there is a poorly preserved, single to locally segmented esker train and associated flanking apron of finer-grained silt and sand extending along and paralleling the Peterlong Lake-Kapiskong Lake water course. To the east, in Zavitz and Hutt Townships, there are several smaller, widely spaced, subsidiary esker trains that are typically single, sinuous ridges with short local branches. These subsidiary eskers are separated from the main esker complex in English and Semple Townships by prominent north-trending ridges of intermittent outcrop. These ridges are generally covered by lacustrine silt and fine sand; in places a discontinuous thin mantle of basal stoney sand till underlies these lacustrine deposits.

Eskers and striated bedrock surfaces indicate that the last major ice flow direction across the area was between S10°W and S30°W. Most of the older drift cover has been destroyed by and incorporated within this last Wisconsinan ice transgression. Boissineau (1968) postulates that this ice-front halted along the Chapleau I Moraine, a regional east-trending belt of morainal deposits less than 16 km south of the map area, before it readvanced southward to form several successively younger regional moraines.

Sado and Clarke (1974) interpreted the wide variety of intermixed glacial sediments in southeastern Hutt Township, ranging from sorted silts, sands, and gravels to unsorted stoney sand till, as ice contact deposits. These sediments are correlated with the Campbell Lake ice-contact deposits to the southeast of the map area, in northeastern Halliday and northwestern Midlothian Townships. Boissineau (1968) correlates these ice-contact deposits with the Chapleau I ice marginal position.

During the Recent Epoch, organic material has accumulated in poorly drained muskeg and swampy areas, usually over silty materials of lacustrine or alluvial origin; also, some recent alluvial material occurs in stream beds.

STRUCTURAL GEOLOGY

Folding

In the northwestern part of the map area, the metavolcanics adjacent to and partially engulfed by the Peterlong Lake Complex form a steeply dipping, easterly-facing homoclinal succession on the south limb of an east-plunging anticline. The axial trace of this anticline trends easterly across the northern part of Musgrove, Bartlett, and Geikie Townships, about 8 km north of the map area. Although only a few top determinations could be made in the metavolcanics in English Township, an eastward-facing succession is also interpreted by Pyke (1978a) because no repetition of stratigraphic units was detected in the region.

In the southern and eastern part of the map area, the main fold structure is a complementary northeast to easterly plunging synform. The axial trace (not shown) of this synform trends northeast across southeastern English and southwestern Zavitz Townships, but changes to a more easterly trend southwest of Kitchiming Lake in central Zavitz Township. Secondary folds in the southwestern part of this synform trend northeast or east and plunge eastward, in the same direction as the main structure. In contrast, secondary folds in the eastern part of the map area trend predominantly east, but plunge to the west.

North- to northeast-plunging open cross-folds occur near Muskasenda Lake in northwestern English Township and near West Nighthawk Lake in eastern Zavitz Township. The cross-folding near Muskasenda Lake appears to be related to the late tectonic emplacement of the Moher Pluton. The cross-folding near West Nighthawk Lake, together with the presence of several small granitic stocks and related dikes, suggests that the previously folded strata in this area have been subsequently deformed during the emplacement, at shallow depth, of an unexposed late tectonic granitic pluton. The granodioritic Geikie Pluton, the southwestern margin of which underlies northwestern Zavitz Township, domed and locally cross-folded the adjacent metavolcanics during its emplacement (Pyke 1978b).

Faulting

There are three major fault trends in the Ferrier Lake-Canoeshed Lake area: north-northwest, northwest, and northeast. Few of the faults are exposed; the existence of most has been interpreted through offsets in geological and geophysical boundaries.

Repeated movement on some of these faults has complicated the age relationships. The north-northwest-trending faults are probably the oldest although the most recent fault movement in the map area appears to have taken place along these same faults.

NORTH-NORTHWEST-TRENDING FAULTS

Two major north-northwest-trending faults with left-lateral displacement traverse the area and have been traced over long distances beyond the boundaries of the area (Bright 1971; Pyke *et al.* 1977). They correlate with the regional swarm of north-northwest-striking faults which extends from Sudbury to the Kapuskasing Structural Zone near Timmins (Ayres *et al.* 1971).

The Mattagami River Fault (Bright 1971) extends through Beemer and Moher Townships, parallel to the Peterlong Lake-Kapiskong Lake watercourse. On the Peterlong Lake-Kapiskong Lake Fault, the contact between the metavolcanics and the granitic rocks has an indicated left-lateral strike separation of approximately 6.1 km. Many north-northwest-trending diabase dikes assigned to the 2485 m.y. old Matachewan swarm (Fahrig *et al.* 1965) parallel this fault zone and some dikes appear to occupy the fault. Repeated movement along this fault is indicated by the possible 2.6 km left-lateral strike separation of the northeast-trending Middle to Late Precambrian quartz diabase dike in southeastern Moher Township.

The second major north-northwest-trending fault, the southern extension of the Burrows-Benedict Fault (Ferguson *et al.* 1968), crosses central Zavitz and Hutt Townships. In the map area, it is known as the Grassy River Fault since it follows the course of the Grassy River in southern Zavitz and northern Halliday Townships. Steeply northward dipping metavolcanic marker horizons in Hutt Township have a possible left lateral strike separation, along this fault, of about 1.2 km. A major upward vertical movement on the east side of the Grassy River Fault, combined with the northward dip of the metavolcanics, could account for most of this strike separation. In south-central Zavitz Township, this fault appears to dislocate a northwest-trending, Middle to Late Precambrian olivine diabase dike, producing a left-lateral strike separation of about 300 m. The difference between the strike separations of this steeply dipping diabase dike and the northward-dipping metavolcanics is probably due to repeated movements on the fault.

The earliest movement on the north-northwest-trending faults appears to postdate the intrusion of the large granitic plutons and predate the intrusion of the Early Precambrian diabase dikes; the most recent movement definitely postdates the intrusion of some of the Middle to Late Precambrian diabase dikes.

NORTHWEST-TRENDING FAULTS

A number of northwest-trending faults, some with left-lateral displacement, traverse the area. These faults correlate with the regional swarm of northwest-striking faults which defines and borders the Lake Timiskaming rift system (Lovell and Caine 1970) to the east of the map area.

The southward extension of the northwest-striking Scott Lakes Fault (Pyke 1978b) in Bartlett Township crosses northeastern English Township and southwestern Zavitz Township. A left-lateral displacement of about 1.7 km on this fault is indicated by the strike separation of the northeast-trending Middle to Late Precambrian quartz diabase dike southeast of Muskrat Lake.

This same dike is offset by another northwest-trending fault, the English Lake Fault, in southeastern English Township; a left-lateral movement of about 400 m is indicated. South and west of English Lake, the metavolcanics adjacent to this fault are highly sheared and drag folded. The shearing dips 30°NE and the drag folds, mainly right-lateral, plunge 25°N to 45°NE. This suggests that the rocks on the northeastern side of the English Lake Fault moved upward and to the left, relative to those on the southwestern side.

Most of these faults cannot be traced over long distances, and in general appear to merge with or be truncated by the north-northwest-striking faults. Although both groups of faults offset the northeast-trending Middle to Late Precambrian quartz diabase dikes, the northwest-striking faults probably postdate the earliest movement on the north-northwest-striking faults. The age relationship between the northwest-striking group of faults and the northeast-striking group is uncertain. One Middle to Late Precambrian olivine diabase dike in the southwestern corner of Hutt Township appears to occupy a northwest-striking fault; this group of faults may have in part controlled the emplacement of the northwest-trending diabase dike swarm.

NORTHEAST-TRENDING FAULTS

A group of northeast-striking faults was recognized in the area. Of particular interest are several closely spaced faults in southern Semple Township. A similar group of faults was mapped (Bright 1970) to the south of the Ferrier Lake-Canoeshed Lake area, in Halliday Township. Most of these faults have a right-lateral displacement and none have been traced over any great distance. One of the more prominent faults in this group, the Parting Lake Fault, is located in southwestern Semple Township. Southwest of Parting Lake, the metavolcanics are in fault contact with the Moher Pluton. This fault and others in the vicinity of Parting Lake appear to be steeply dipping normal faults, on which the indicated sense of movement is east side down relative to the west side. To the southwest of the present map area, in Sothman Township, the Parting Lake Fault appears to be truncated by the northerly trending Peterlong Lake-Kapiskong Lake Fault (Pyke *et al.* 1973).

Another prominent northeast-striking fault, the Redwing Fault, is located in northeastern Hutt Township. On the north side of the Redwing Fault, the metavolcanics trend east-southeast, whereas, on the south side, they trend

northeast. This sharp contrast suggests that the metavolcanics on the northern side of this fault may form part of the northern limb of a broad anticlinal cross-fold which has been truncated along its axial region by the Redwing Fault.

ECONOMIC GEOLOGY

The Ferrier Lake-Canoeshed Lake area has been prospected for gold and iron since the early 1920s. The first notable mineral discovery was made in the early 1930s when J.C. Nelson found an interesting gold-bearing quartz stringer zone on his claims, now the F. Boychuck (West Muskasenda group) property (number 5 on Map 2290, back pocket), near the southwest shore of Muskasenda Lake in northwestern English Township. In recent years, most exploration efforts have been directed toward the search for base metal deposits. No economic mineral deposits have been outlined to date, however, the discovery and subsequent development of two gold deposits, two nickel deposits, and one asbestos deposit within a 13 km radius of the map area has helped to stimulate and maintain a continuing program of mineral exploration in the region. Since Nelson's discovery, other occurrences of gold and silver have been reported, as well as several economically interesting occurrences of copper, zinc, asbestos, iron, and nickel.

The following introductory section briefly describes the general modes of occurrence of gold, copper, asbestos, and nickel mineralization in the map area; iron is discussed in more detail in a previous section dealing with iron formation under General Geology. A more detailed description of the various properties, other mineral occurrences, and types of exploration programs carried out is given in the last section of this report.

Gold

Gold and related silver mineralization in the area is found mainly in quartz or quartz-carbonate veined, sheared, pyritized metavolcanics and metagabbros which are cut by dikes of felsite and feldspar porphyry. The mineralized zones near Muskasenda Lake in northwestern English and northeastern Beemer Townships are associated with northerly- and easterly-trending sheared or fractured zones in steeply dipping strata that were cross-folded during the emplacement of the Moher Pluton and related late epizonal granitic dikes. The southeastern part of Zavitz Township is another area of cross-folding and intrusion by late granitic plutons. Two gold occurrences, located about 0.3 km northwest of Moray Lake, are associated with quartz veins and stringers in sheared portions of a late porphyritic syenite stock.

The gold mineralization near English Lake and the Redstone River in southeastern English and northeastern Semple Townships is associated, on a local scale, with shear and fracture zones of various trends in the metavolcanics. However, on a regional scale, these gold occurrences may be related to the large northwest-trending and northeast-dipping reverse thrust fault that

passes through northwestern Hutt and northeastern Semple Townships. Quartz veins and fine-grained granitic dikes are relatively abundant in a zone about 1 km wide on either side of this fault. The fact that most of the quartz veins and reported gold occurrences occur on the south side (footwall) of this fault may be useful in future exploration for gold in the area. Economically interesting gold mineralization has been reported from the following properties and occurrences:

(i) F. Boychuck (South Muskasenda group) (number 4 on Map 2290, back pocket),

(ii) F. Boychuck (West Muskasenda group) (number 5 on Map 2290, back pocket),

(iii) Hollinger occurrences (Redstone River group) (numbers 8, 26, and 34 on Maps 2290 and 2291, back pocket),

(iv) Robinson occurrence (number 16 on Map 2290, back pocket),

(v) Sylvanite occurrence (number 2 on Map 2289, back pocket).

Copper

In southeastern Zavitz Township, economically interesting occurrences of volcanogenic-type copper and copper-zinc mineralization are associated with zones of disseminated to massive sulphides within the felsic metavolcanics. Within the felsic metavolcanics throughout English Township, minor to trace amounts of copper, occasionally with minor zinc and lead mineralization are associated with some interbeds of siliceous sulphide-bearing iron formation. An isolated stringer of massive chalcopyrite in felsic metavolcanics was observed in a section of diamond-drill core from a hole drilled immediately north of the southern boundary of Hutt Township and midway between the power line and the Grassy River. These metavolcanics correlate directly with the felsic metavolcanics in Halliday Township located immediately south of Hutt Township. On a regional scale, the felsic metavolcanics in southern Hutt Township and northeastern Halliday Township are interpreted to be at the same stratigraphic interval as the host rocks for the copper and copper-zinc mineralization in southeastern Zavitz Township.

Future exploration for volcanogenic-type copper-zinc deposits in the region should therefore concentrate on the stratigraphically equivalent felsic metavolcanics in the east-central and southeastern parts of the map area, as well as on the strike extension of these rocks in adjacent parts of Hincks, Montrose, and Halliday Townships.

Copper mineralization also occurs at several localities near the southeast arm of Kitchiming Lake in northwestern Zavitz Township. The mineralization, mainly pyrite, pyrrhotite, and minor chalcopyrite, is restricted to a thick unit of pillowed, amygdaloidal mafic metavolcanics in the upper part of the second volcanic cycle in the northern part of the map area. The sulphide minerals occur primarily as amygdule fillings, and secondarily as massive stringers and disseminated grains in flow top breccia zones or in primary hollows between pillows.

Minor chalcopyrite is associated with many of the gold occurrences and usually occurs as disseminated grains in both the quartz veins and the adjacent sheared and pyritized wallrocks.

Economically interesting copper mineralization has been reported from the following properties and occurrences:

(i) Amax Exploration Incorporated (Adele group) (number 30 on Map 2291, back pocket),

(ii) F. Boychuck (West Muskasenda group) (number 5 on Map 2289, back pocket),

(iii) J. Helpert (number 13 on Map 2290, back pocket),

(iv) Noranda Exploration Company Limited (number 15 on Map 2290, back pocket),

(v) Voyager Explorations Limited (number 19 on Map 2290, back pocket).

Asbestos

Minor showings of cross-fibre asbestos occur locally in the ultramafic rocks of southern Semple, southeastern Zavitz, and northeastern Hutt Townships.

The best reported occurrences of cross-fibre asbestos are in the crescent-shaped, layered, ultramafic-mafic sill located east of Parting Lake on the Daniel Mining Company Limited property (number 23 on Map 2291, back pocket) in southern Semple Township. In 1951 and 1952, Dominion Gulf Company diamond-drilled about 20 holes into this sill in order to test its asbestos potential. A fibre count, carried out over an 82.6 m core length in one of the holes, yielded the following results: 404 veinlets with a width of 0.8 mm, 39 with a width of 1.6 mm, and 4 with a width of 3.2 mm[1].

Nickel

Minor and trace amounts of nickel are associated with the Early Precambrian ultramafic intrusive and extrusive rocks in the map area. A 130 m diamond-drill hole, put down on the large crescent-shaped ultramafic-mafic sill east of Parting Lake in Semple Township, yielded an average value of 0.26 percent Ni over the entire hole; assays of selected core sections ranged from 0.35 percent Ni to 0.41 percent Ni over core lengths of 3.0 m.[1].

The extrusive character of the sheared and serpentinized ultramafic rocks near Muskrat Lake in northeastern English Township was first recognized by Pyke (1978a) during the regional survey of the Peterlong Lake area. No nickel assays have been reported from these ultramafic metavolcanics, however, it is important to note that the Texmont Mine nickel orebody occurs in this same ultramafic metavolcanic formation in Geikie Township (Pyke 1978b) about 8.0 km north of the map area.

[1]Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

Similarly, to the author's knowledge, the nickel potential of the sill-like bodies of ultramafic rock near Moray Lake in southwestern Zavitz Township has not been seriously tested. Although there is no positive field evidence of a flow origin for these ultramafic rocks, they do occur at or near the same stratigraphic interval as the ultramafic flows near Muskrat Lake, and therefore could also be favourable host rocks for nickel mineralization.

Description of Properties, Occurrences, and Exploration

Information on older properties within the Ferrier Lake-Canoeshed Lake area is contained in the report by Gledhill (1926). All of the more recent exploration information and some additional data on the older properties has been extracted from the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake and from the Assessment Files Research Office, Ontario Geological Survey, Toronto.

Only those properties, occurrences, and areas of exploration for which geoscience data was available prior to December 1968 are described in this report. The one exception is the J. Helpert property (number 13 on Map 2290, back pocket) which the author examined in 1971.

In this report, properties are named according to ownership as of December 1968, e.g. F. Boychuck (South Muskasenda group). Occurrences are named after a previous owner, a geographic area, or a name by which the property is otherwise known, e.g. Hollinger occurrence (Redstone River group). Areas of exploration are named after the company that performed the work. A date in square brackets following the name indicates the last year of unencouraging exploration activity, if prior to December 1968. The number in round brackets following the name is the number of the property on the appropriate geological map in the back pocket.

For all properties discussed, the reader is referred to Maps 2289, 2290, and 2291 (back pocket) published in 1974. More recent information on exploration activity in the map areas is available from the Assessment Files Research Office, Ontario Geological Survey, Toronto and from the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

AMAX EXPLORATION INCORPORATED

In 1966, Amax Exploration Incorporated completed an airborne geophysical survey of Semple, Hutt, Halliday, and Sothman Townships. As a result of this survey, the company staked five small claim blocks in Hutt and Semple Townships to cover several airborne anomalies. In 1967, Amax carried out ground magnetic and electromagnetic surveys over most of these claim groups and subsequently put down several diamond-drill holes to test certain electromagnetic anomalies. No record of this exploration work was submitted for assessment purposes, however, Amax kindly allowed the author to examine private company reports concerning their properties in the area. The following

account of the exploration work done on their five claim groups is summarized from these reports.

Parting Lake Group (21)

This group is located immediately east of the road at the north end of Parting Lake in central Semple Township. The property is completely masked by glacial esker sand deposits, but the bedrock is believed to be mainly mafic to intermediate metavolcanics. The author is not aware of any follow-up diamond drilling having been done on this property by Amax.

Foy Lake Group (22)

This group is located south and southeast of Foy Lake near the eastern boundary of Semple Township. The property is largely underlain by light grey-green, tremolite-rich, mafic to intermediate metavolcanics with subordinate units of dark green, actinolite-rich, mafic to intermediate metavolcanics. Amax diamond drilled two holes (footage unknown) on the property and examined a nearby minor occurrence of pyrite and pyrrhotite in the tremolitic mafic to intermediate pillow lavas.

Adele Group (30)

This group is located along the southern boundary of Hutt Township between the east branch of the Grassy River and the power line. The property is largely underlain by mafic to intermediate metavolcanics, with minor intercalated felsic metavolcanics. A 247 m diamond-drill hole was put down immediately east of the small lake on the township boundary to test a conductive zone outlined by geophysical surveying. This hole intersected 15 m of felsic breccia containing 1 to 2 percent pyrite; then 78 m of graphitic tuff containing disseminated to massive pyrite; and finally 154 m of intercalated intermediate to felsic flows and breccias containing an average of 6 percent pyrite. In the core from a second hole, drilled further to the west on this same conductive zone, the author observed an isolated stringer of massive chalcopyrite, about 1.3 cm wide, in what appeared to be an otherwise unmineralized 1.5 m core section of fractured and altered felsic metavolcanics.

Luke Lake Group (31)

This group is located between Luke Lake and Redwing Creek in northeastern Hutt Township. The property is largely underlain by felsic tuff and tuff-breccia, with minor interbeds of graphitic tuff and subordinate mafic to inter-

mediate flows and flow-breccia. Along the east side of Luke Lake, the metavolcanics are intruded by a discordant lenticular body of ultramafic to mafic rocks. Amax drilled three conductive zones in felsic pyroclastics on the property; in each case, the holes intersected graphitic tuff containing disseminated to locally massive pyrite.

Shear Lake Group (32)

This claim group is located along the south shore of Shear Lake in east-central Hutt Township. The property is underlain mainly by mafic to intermediate flows. The author observed a localized area of disseminated pyrite, pyrrhotite and minor chalcopyrite mineralization in a narrow interflow unit of felsic tuff on the south shore of Shear Lake. Another minor occurrence of chalcopyrite mineralization in felsic metavolcanics was found about 610 m southwest of Shear Lake. The author is not aware of any diamond drilling having been done on this property by Amax.

F. BOYCHUCK (SOUTH MUSKASENDA GROUP) (4)

In 1968, F. Boychuck of Timmins held a contiguous group of 44 unsurveyed claims surrounding the southern end of Muskasenda Lake in western English Township. The northern portion of this claim group, near the 4-mile post on the Beemer-English township boundary, is described as the F. Boychuck (West Muskasenda group) property (5).

The entire claim group straddles the contact between a thick unit of mafic to intermediate metavolcanics and an overlying unit of felsic metavolcanics. The north-trending Muskasenda Lake metagabbroic sill complex, which was emplaced along the contact between these two metavolcanic sequences, underlies the central part of the property. This major intrusive complex consists of a lower pyroxenite-gabbro sill along the west and south shores of Muskasenda Lake and an upper gabbro sill along the east shore of the lake. Screens of intermediate to felsic pyroclastics separating the two sills are exposed along the shore and on some of the islands in the lake. Both the metavolcanics and the metagabbro exposed along the southern and western parts of Muskasenda Lake are cut by a strong north-trending shear zone, as well as a weaker but readily apparent east-trending shear-fracture system. The sheared country rock is locally mineralized with disseminated pyrite and minor chalcopyrite, and cut by late tectonic quartz-feldspar porphyry dikes, fine- to medium-grained granitic to dioritic dikes, aplite, and lamprophyre dikes; and numerous veins, stringers, and stockworks of quartz, quartz-calcite, and epidote-carbonate. The main gold-bearing quartz-carbonate vein system in the metagabbro on the southern shore of Muskasenda Lake (Figure 2) was formerly held by Transterre Exploration Limited.

In 1965, Transterre put down five diamond-drill holes totalling about 550 m to test the strike extension of the main north-trending quartz-carbonate vein system exposed on the western point of the peninsula at the south end of the

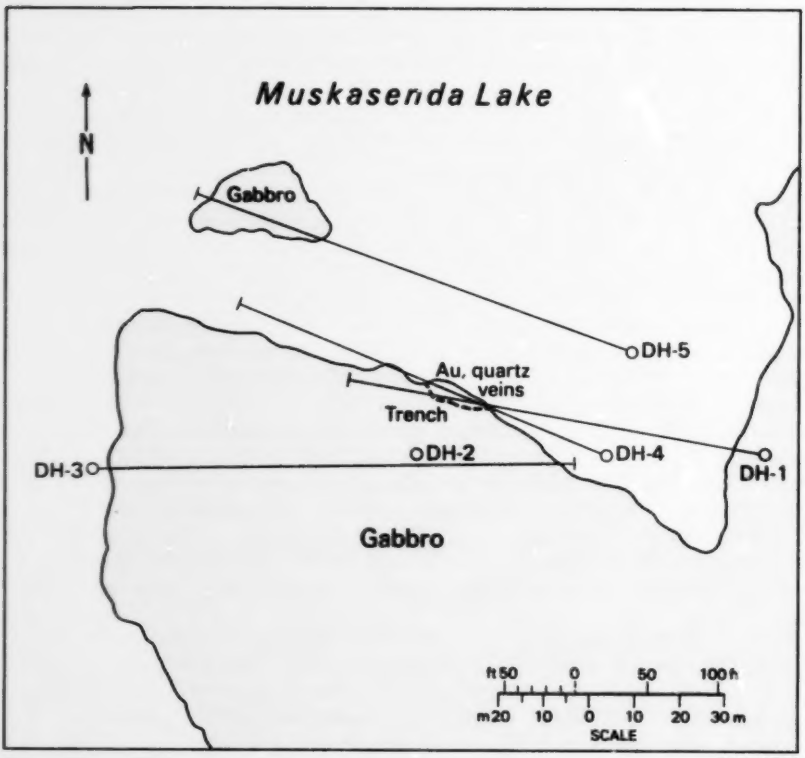

Figure 2–Location of the gold showing and surface diamond-drill holes on the F. Boychuk (South Muskasenda group) property (4) in western English Township.

lake. The sheared metagabbro adjacent to the veins is strongly chloritized, and locally silicified, carbonatized, and mineralized with disseminated pyrite, pyrrhotite, and minor chalcopyrite. Drill hole No. 1 (Figure 2), put down beneath the main surface showing, intersected four separate gold-bearing zones. Assays obtained were 0.015 ounce of Au per ton over 1.8 m, 0.32 ounce of Au per ton over 0.6 m, and 0.01 ounce of Au per ton over 0.6 m[1]. Assay results reported for the other four drill holes ranged from trace to 0.03 ounce of Au per ton over short sections of core. Transterre allowed their claims to lapse the following year.

The author examined the property in 1967, at which time the current owner, F. Boychuck, was carrying out a trenching and sampling program on the main surface occurrence. Blasting had produced a shallow cut, about 6 m wide, across the showing in the cliff-face near the shoreline of the lake. On the vertical face of the pit, the sheared and chloritized metagabbro is locally brecciated and cut by an interlacing network of quartz and quartz-carbonate veins and stringers containing sulphides. The most prominent vein system trends N20°E to N50°E and dips about 50 degrees east. The altered wall rock, as well as numerous wall rock fragments within the larger veins, contain disseminated pyrite with minor pyrrhotite and chalcopyrite. A selected grab sample of crumbly, limonite-coated quartz and wall rock gouge, taken by the author from a prominent north-trending but shallow-dipping zone in the pit-face, assayed 13.4 ounces of Au per ton, 13.1 ounces of Ag per ton, and 1.66 percent Cu (analysis by Geoscience Laboratories, Ontario Geological Survey, Toronto). The author considers the very high and almost equal values of gold and silver from this shallow-dipping shear zone to be the result of secondary enrichment by recent circulating groundwater.

In 1968, the South Muskasenda group and the southern part of the west Muskasenda group of property (5), was optioned by Cyprus Exploration Corporation Limited. The company completed a geological survey of the entire property and conducted ground magnetic and electromagnetic surveys over selected portions of the ground. Most of their follow-up work was concentrated near the copper showing on the north shore of the small bay at the southwest corner of Muskasenda Lake (F. Boychuck (West Muskasenda group) property (5)).

F. BOYCHUCK (WEST MUSKASENDA GROUP) (5)

In 1968, F. Boychuck also held a group of unsurveyed claims near the 4-mile post on the Beemer-English township boundary. This claim group included the former Nelson gold prospect in previously surveyed claim TRS1759 (restaked as claim MR45573). This gold prospect within Boychuck's entire claim holdings was not optioned or explored by Cyprus during the 1968 period in which they carried out work on his South Muskasenda group and the southern part of his west Muskasenda group.

[1]Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

In 1935, Sylvanite Gold Mines Limited optioned the former Nelson gold prospect and carried out a program of sampling and trenching in former claim TRS1759. The gold mineralization is restricted to a shear zone in the metavolcanics adjacent to the southeast-trending upper contact of the lower gabbroic sill in the Muskasenda Lake metagabbro complex. The metagabbro does not seem to be sheared. In the metavolcanics, the shear zone strikes N75°E, dips 63 degrees north, and, in the vicinity of the main showing, follows the local trend of the metagabbro sill; in former claim TRS1759, the zone averages about 24 m in width and was traced over an approximate strike length of about 61 m. In the vicinity of the largest trench, a 21 m long section near the centre of the shear zone was sampled and analysed. Here the shear zone is well-mineralized with disseminated pyrite and cut by numerous quartz stringers. Gold assays averaged 0.14 ounce of Au per ton across widths of 1 m and for a strike length of 8.5 m near the large trench at the eastern end of the mineralized zone[1].

The copper showing on the north shore of the small bay at the southwest corner of Muskasenda Lake consists of disseminated pyrite and chalcopyrite in the sheared portion of an easterly-trending quartz-feldspar porphyry dike. The dike itself cuts north-trending intermediate to felsic metavolcanics, but the northeast-trending shear zone, where exposed, only cuts the quartz-feldspar porphyry dike. The sulphide mineralization is restricted to the sheared portion of the dike. This mineralized shear zone strikes northeasterly, following the long axis of the small bay leading to the Mountjoy River, and only just intersects the north shore of the bay and the dike before disappearing beneath the main part of Muskasenda Lake. Nowhere was this shear zone observed cutting the metavolcanics or the metagabbro sill. There is no record that Cyprus Exploration Corporation Limited drilled this mineralized shear, either under Muskasanda Lake or along the Mountjoy River, during their examination of Boychuck's South and West Muskasenda groups.

CANADIAN NICKEL COMPANY LIMITED [1964] (11)

Canadian Nickel Company Limited formerly held a small group of unsurveyed claims, situated east of West Nighthawk Lake near the 92-mile post on the Sudbury-Timiskaming territorial district boundary.

The claims are underlain by an irregular-shaped outlier of rusty weathering polymictic conglomerate containing intercalated discontinuous interbeds of felsic tuff and graphitic tuff. The discordant attitude of the bedding in this metasediment, with respect to the regional trend, indicates a possible unconformable relationship with the surrounding mafic to intermediate pillow lavas.

In 1964, Canadian Nickel put down two diamond-drill holes, totalling 223 m. Disseminated pyrite was encountered in the matrix of the conglomerate as well as in a graphitic tuff horizon in the conglomerate; locally, disseminated pyrite and pyrrhotite were observed in the underlying mafic to intermediate metavolcanics.

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[1]Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

CONIGO MINES LIMITED (6)

Conigo Mines Limited held 12 unsurveyed claims, MR40485 to MR40490 inclusive and MR40566 to MR40571 inclusive, straddling the secondary road in northeastern English Township. The claims include the former Cropsey iron prospect previously described by Gledhill (1926).

The property is underlain by the lower portion of a thick unit of intermediate to felsic metavolcanics, largely pyroclastic rocks. Narrow discontinuous bands of oxide- and sulphide-facies iron formation are intercalated with the metavolcanics in the center of the claim group.

In 1966, Conigo completed ground magnetic and electromagnetic surveys over the property. A northeast-trending magnetic conductive zone was traced for about 900 m across the property. Trenching over this conductive zone, near the west shore of a small lake in the southern part of the claim group, exposed a 0.3 to 3.0 m wide unit of banded magnetite-chert and pyrite-pyrrhotite-chert iron formation in felsic pyroclastics. Two diamond-drill holes, totalling 304 m, were put down to test the base metal potential of the iron formation. No assay results were reported and only disseminated pyrite and pyrrhotite mineralization was reported in the drill logs.

DANIEL MINING COMPANY LIMITED (23)

In 1968, Daniel Mining Company Limited held a group of 11 unsurveyed claims, MR47504 to MR47514 inclusive, surrounding the small lake near the nose of the large, easterly-plunging, crescent-shaped, ultramafic to mafic intrusive sill in south-central Semple Township. This property was previously held by Dominion Gulf Company; the general geology and earlier exploration of this area is discussed in the section dealing with Dominion Gulf Company (property 24).

In 1967, Daniel Mining put down three diamond-drill holes, totalling 379 m, in claim MR27506 to test the nose-area of the folded ultramafic-mafic sill for cross-fibre asbestos. Drill records[1] reported only minor cross-fibre asbestos in the core.

DOMINION GULF COMPANY [1951-1952] (12)

Dominion Gulf Company formerly held a group of 26 unsurveyed claims, S56635 to S56660 inclusive, between Luke and Moray Lakes in southeastern Zavitz Township. The property, originally staked as an asbestos prospect, is largely underlain by felsic metavolcanics; subordinate intercalated sill-like units of ultramafic to mafic rocks are found in the metavolcanics near Moray, Dexter, and Luke Lakes. No field evidence of an extrusive origin for these ultramafic-mafic units was observed by the author.

[1]Assessment Files Research Office, Ontario Geological Survey, Toronto.

In 1951 and 1952, Dominion Gulf carried out magnetic and geological surveys over the property, but no follow-up diamond-drill program was reported. Two minor occurrences of cross-fibre asbestos were reported: (1) in serpentinized ultramafic rocks on the peninsula in Moray Lake, and (2) in serpentinized ultramafic rocks on the northeast shore of Luke Lake. Samples taken from several minor occurrences of disseminated pyrite and pyrrhotite in the felsic pyroclastics west of Moray Lake yielded nil or trace values in gold and base metals[1].

DOMINION GULF COMPANY (1951-1952) (24)

Dominion Gulf Company formerly held a group of about 130 unsurveyed claims which covered most of southeastern Semple Township. The property was bounded on the west by Parting Lake, on the north by the Redstone River, on the northeast by Foy Lake, and on the south and east by the township boundaries. The property was staked as an asbestos and base metal prospect following an airborne magnetic survey of the area, flown in 1949.

The property is largely underlain by part of a thick formation of massive to pillowed mafic to intermediate metavolcanics containing minor interflow units of intermediate to felsic pyroclastics. The highly folded metavolcanics contain two large, differentiated, ultramafic to mafic sill complexes. The largest, an easterly-plunging, crescent-shaped, differentiated sill east of Parting Lake is the dominant feature in the western part of the property. The second, a smaller differentiated sill situated south of Foy Lake, is the dominant feature in the eastern part of the property. Numerous small, lenticular to irregularly shaped bodies of predominately mafic intrusive rocks also intrude the metavolcanics, particularly in the southern part of the property near Cork Lake.

In 1951 and 1952, Dominion Gulf completed a ground magnetic survey over the entire property, and most of the claims were mapped at a scale of 1 inch to 400 feet. Near the ultramafic-mafic sill southwest of Foy Lake, several occurrences of disseminated pyrite-pyrrhotite-chalcopyrite (minor) mineralization in the interflow units of intermediate to felsic tuff were trenched and sampled. Samples yielded nil or trace amounts of copper, gold, and silver[1]. Near the 2-mile post on the southern boundary of Semple Township, several zones of altered and mineralized metavolcanics, cut by pyrite-bearing quartz-feldspar porphyry dikes, were also trenched and sampled. Samples of the mineralized dikes and asociated quartz stringers yielded nil or trace amounts of gold and silver[1].

Dominion Gulf found little or no cross-fibre asbestos or sulphide mineralization in the numerous outcrops of serpentinized ultramafic rocks belonging to the differentiated sill southwest of Foy Lake. No follow-up diamond-drill program was undertaken to test this sill for asbestos or nickel.

In contrast, some cross-fibre asbestos was found by Dominion Gulf in an outcrop on the northwest arm of the crescent-shaped ultramafic-mafic sill east

[1]Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

of Parting Lake. Initially, the company diamond-drilled 12 holes, totalling 1981 m to test the asbestos potential of this sill. A drill hole near the surface outcropping of cross-fibre asbestos yielded the following fibre count over a core length of 82.6 m: 404 veinlets with a width of 0.8 mm, 39 with a width of 1.6 mm, and 4 with a width of 3.2 mm[1]. By the end of 1952, the company had drilled an additional eight holes (footage unknown) in this sill; no fibre counts or nickel assays were reported from this work. In 1957, Canadian Johns-Manville Company Limited re-examined the asbestos potential of this sill for the Dominion Gulf Company. Presumably no significant amounts of cross-fibre asbestos were outlined, and shortly thereafter Dominion Gulf allowed all their claims in Semple Township to lapse.

In 1964, Mining Corporation of Canada (1964) Limited restaked most of this same crescent-shaped, ultramafic-mafic sill. In 1965, this company carried out magnetic and electromagnetic surveys over the nose-area of the folded sill, and subsequently drilled several holes to test the nickel potential of the intrusion. An easterly-dipping diamond-drill hole, collared on the northeast shore of the small lake near the nose of the intrusion, returned an average of 0.26 percent Ni over a 130 m section of core; in parts of this section, assays ranged as high as 0.35 and 0.41 percent Ni, both over a core length of 3.0 m[1].

In 1968, most of the crescent-shaped, ultramafic-mafic sill complex was under option to or held by Daniel Mining Company Limited, and the smaller sill southwest of Foy Lake was held by Probe Mines Limited. Exploration work by these companies is discussed in the section dealing with Daniel Mining Company Limited (property 24) and Probe Mines Limited (property 28).

DOMINION GULF COMPANY [1951-1953] (7)

Dominion Gulf Company formerly held a group of 12 unsurveyed claims, S62073 to S62084 inclusive, astride the power line west of Muskrat Lake in northeastern English Township. The claims were staked following an airborne magnetic survey flown by the company in 1949.

The property straddles the boundary between a sequence of felsic metavolcanics, the terminating phase of the first volcanic cycle in the northern part of the map area, and a younger cycle of ultramafic-mafic to intermediate metavolcanics. A north-trending band of magnetite-chert iron formation, at or near the stratigraphic top of the felsic pyroclastics, crosses the claim group west of Muskrat Lake. Near the west shore of Muskrat Lake, the iron formation is directly overlain by serpentinized ultramafic metavolcanics.

Between 1951 and 1953, Dominion Gulf completed a ground magnetic survey over the property, and most of the claims were mapped at a scale of 1 inch to 400 feet. Selected areas of the iron formation were sampled for their iron and base metal potential, and the ultramafic rocks were tested for their nickel potential. Assay results[1] were not encouraging and no follow-up work was undertaken. Subsequent exploration work on part of this claim group is discussed un-

[1]Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

der the section dealing with Texmont Mines Limited (10).

Near the northern boundary of English Township, this iron formation unit consists of two thinly bedded magnetite-chert bands, each about 12 m wide. Minor disseminated pyrite and pyrrhotite are present in some magnetite-chert layers, as well as in the intervening felsic tuff units. About 900 m along strike to the south, these two closely spaced iron formation bands merge to form a single band that pinches and swells between 15 and 60 m in thickness for an additional strike length of about 1500 m. The magnetite-rich layers are thicker, up to 0.9 m wide, and more abundant in the wider southern extension of this iron formation band. In several places, along the stratigraphic base of this unit south of Muskrat Lake, the underlying felsic pyroclastics grade upward through a 0.6 to 4.6 m wide magnetite-rich breccia zone into bedded magnetite-chert iron formation. In places, the magnetite-rich siliceous matrix constitutes up to 95 percent by volume of the unit. A selected sample, taken by the author on the power line about 610 m south of Muskrat Lake, contained 30.8 percent Fe and 0.03 percent TiO_2; trace element analysis indicated 75 ppm As, 50 ppm Zn, 40 ppm Sb, 10 ppm Cu, 10 ppm Pb, 10 ppm Ni, 5 ppm Sn, 5 ppm Mo, and 3 ppm Co (analyses by the Geoscience Laboratories, Ontario Geological Survey, Toronto).

FOX OCCURRENCE (33)

In the early 1920s, Tom Fox prospected a zone of disseminated pyrite. This zone occurs in sericitized felsic metavolcanics adjacent to an aplite dike that outcrops along the south bank of Hutt Creek, approximately half way between Canoeshed Lake and Wellington Lake in central Hutt Township. Samples taken from this showing by Gledhill (1926) did not contain any gold.

J. HELPERT [1971] (13)

In 1971, J. Helpert held a group of nine unsurveyed claims, MR292702 to MR292710 inclusive, surrounding the southeast arm of Kitchiming Lake in northeastern Zavitz Township. Following the author's field work in this area, Daniel Rochon and William Dallaire, two prospectors from Timmins, uncovered several interesting new occurrences of chalcopyrite mineralization in the mafic to intermediate pillow lavas on this property in 1970. The author revisited the area in 1971 and examined this new copper prospect.

The claim group is largely underlain by an easterly-trending unit of amygdaloidal, dark greyish green, massive to pillowed flows. In the northern part of the claim group near Kitchiming Lake, this metavolcanic unit is stratigraphically underlain by a thick unit of characteristically magnetic, black, variolitic mafic pillow lavas; a strikingly similar sequence of black variolitic pillow lavas stratigraphically overlies the dark greyish green amygdaloidal pillow lavas in the southern part of the property. Structurally, these mafic to intermediate metavolcanics lie on the north limb of a westerly-plunging, local syncline.

The copper mineralization is mainly restricted to the dark greyish green to dark green, amygdaloidal pillow lavas in the central part of the claim group. These darker green, actinolite-rich, mafic to intermediate metavolcanics contain minor intercalated flow units of light grey-green, tremolite-rich, mafic to intermediate metavolcanics; only pyrite mineralization was observed in the tremolite-rich rocks. In the darker green, actinolite-rich metavolcanics, pyrite-pyrrhotite and chalcopyrite mineralization occurs at several localities, mainly as amygdule fillings, but also as stringers and disseminated grains of sulphide in flow-top breccia zones. The copper mineralization is more abundant in the lower part of the unit, near Kitchiming Lake. Here, massive to banded cherty rhyolite, containing massive to disseminate pyrite, pyrrhotite, and chalcopyrite was observed in several places filling primary hollows between pillows near the top of individual flow units. Pyrite is usually the only sulphide present near the stratigraphic top of this darker green metavolcanic unit; similarly, pyrite is the only sulphide observed in the black, magnetic, variolitic pillow lavas which stratigraphically underlie the dark greyish green, amygdaloidal flows containing the copper mineralization.

In 1971, J. Helpert had stripped the overburden in two places on claim MR292706, across the general trend of the mineralized metavolcanics. Both zones of stripping are about 300 m long and 15 m wide; one zone trends approximately north, the other easterly. A program of selective trenching and bulk sampling was completed over both zones of stripping. Reported assay values[1] ranged from 0.04 to 0.69 percent Cu. Selected 10- to 20-pound bulk samples were taken from several pits in the more highly mineralized amygdaloidal flows near the northern ends of the stripped zones. One such sample assayed 0.69 percent Cu, 0.03 ounce of Au per ton, and 0.24 ounce of Ag per ton[1]. No follow-up geophysical work or diamond drilling were reported.

HOLLINGER OCCURRENCES

Cork Lake Group (25)

Hollinger Consolidated Gold Mines Limited formerly held a row of claims along the southeastern boundary of Semple Township between Cork Lake and the southeastern corner of the township. These claims formed the northern edge of Hollinger's main claim group in northeastern Sothman Township, immediately to the south.

The claims along the southern boundary of Semple Township are largely underlain by mafic to intermediate metavolcanics; subordinate interflow units of intermediate to felsic metavolcanics are present in the eastern part of the claim group. On the claims straddling the township boundary near the 2-mile post, the metavolcanics are cut by several small mafic sills and numerous quartz-feldspar porphyry dikes.

[1]Assessment Files Research Office, Ontario Geological Survey, Toronto.

In 1962, Hollinger completed magnetic and electromagnetic surveys over their claims in Semple and Sothman Townships, and most of the property was geologically mapped at a scale of 1 inch to 400 feet. Near the 2-mile post on the southern boundary of Semple Township, several sulphide showings and pyrite-bearing quartz stringer zones, occurring in the metavolcanics adjacent to quartz-feldspar porphyry dikes, were trenched and sampled. No assays for gold were reported and no follow-up diamond-drill program was undertaken by Hollinger on the claims in Semple Township.

Ferrier Lake Group (9)

Hollinger Consolidated Gold Mines Limited formerly held a group of eight unsurveyed claims, MR32690 to MR32697 inclusive, situated about 2.4 km northeast of Ferrier Lake in central English Township. The property covers a strongly drag-folded segment of a magnetite-chert iron formation band in felsic pyroclastics.

In 1962, Hollinger completed ground magnetic and electromagnetic surveys over the property, and most of the claims were mapped at a scale of 1 inch to 400 feet. The geophysical work indicated strong coincident magnetic and electromagnetic anomalies associated with the iron formation. To test these, six packsack diamond-drill holes, totalling 126 m, were put down near the northwest corner of claim MR32693. Drill logs[1] reported minor disseminated pyrite and pyrrhotite in many of the magnetite-chert layers, as well as disseminated pyrrhotite and magnetite in the matrix of drag-folded and brecciated sections of the iron formation; minor chalcopyrite was locally associated with the pyrrhotite. Numerous quartz, quartz-carbonate, and quartz-potassium feldspar-carbonate veins and stringers cut the fractured and brecciated drill core sections of iron formation and associated metavolcanics. Most veins contain disseminated pyrite; locally, minor chalcopyrite and galena were observed. No assay values were reported for this property.

Redstone River Groups (8, 26, 34)

Hollinger Consolidated Gold Mines Limited formerly held two claim groups near the Redstone River: (1) 67 unsurveyed claims, MR32779 to MR32784 inclusive, MR32799 to MR32806 inclusive, and MR33076 to MR33128 inclusive, in the southeastern corner of English Township (property 8) and the northeastern corner of Semple Township (property 26); and (2) 33 unsurveyed claims, MR35146 to MR35178 inclusive, immediately north and west of Canoeshed Lake in northwestern Hutt Township (property 34).

The claims in English Township (property 8) and Hutt Township (property 34) are largely underlain by felsic pyroclastics, with subordinate mafic to inter-

[1] Assessment Files Research Office, Ontario Geological Survey, Toronto.

mediate pillow lavas and minor discontinuous interbeds of pyrite-bearing iron formation and graphitic tuff. The claims along the northern boundary of Semple Township near the Redstone River (property 26) encompassed the former Alford-McCall and Saville gold prospects, which were optioned by Hollinger in 1962. This part of the property is underlain mainly by mafic to intermediate tuffs, with subordinate mafic to intermediate flows and several narrow, discontinuous units of pyrite-rich iron formation. The tightly folded and sheared metavolcanics on the former Alford-McCall and Saville properties contain numerous dikes and stringers of aplite and felsite; quartz stringers and veinlets, many containing trace amounts of gold, are associated with these late granitic dikes along the Redstone River and near the Wicks Road south of English Lake.

In 1962 and 1963, Hollinger completed ground magnetic and electromagnetic surveys over the property, and most of the claims were mapped at a scale of 1 inch to 400 feet. Three diamond-drill holes, totalling 460 m, were put down to test several conductive zones in the central part of the property in southeastern English Township (property 8). In each case, the drill intersected narrow units of pyrite- and pyrite-magnetite-bearing iron formation intercalated with the felsic pyroclastics. No assay results were reported[1].

West of the Redstone River in northeast Semple Township (property 26) Hollinger put down seven packsack diamond-drill holes, totalling 164 m, to test: (1) the pyrite-rich iron formation bands for gold and base metals, and (2) a number of quartz stringer zones and associated pyrite-bearing aplite and felsite dikes for gold. Gledhill (1926) reported that finely divided gold could be panned from some of the very rusty sulphide-rich zones in the iron formation on this property. At the same time, they drilled six more packsack holes, totalling 82 m, on the former Alford-McCall gold prospect, an area of sheared and carbonatized mafic to intermediate tuff cut by numerous pyrite-bearing quartz stringers, near the road southwest of English Lake. Previously, Edal Mines Limited, who had optioned the property in 1949, reported that samples from pits yielded an assay of 0.04 ounce Au per ton over 23 cm.

In 1962 and 1963, Hollinger put down 15 diamond-drill holes, totalling 1341 m, on their claims west of Canoeshed Lake (property 34) in western Hutt Township and southeast of the Redstone River (property 26) in eastern Semple Township. The company trenched and subsequently drilled two gold prospects near the eastern boundary of Semple Township: (1) A quartz vein containing disseminated pyrite and minor chalcopyrite in an outcrop of sheared mafic to intermediate metavolcanics, located 460 m west of the 5-mile post on the Semple-Hutt township boundary, yielded only traces of gold[2], and (2) pyrite-bearing quartz veins, associated with quartz-feldspar porphyry dikes occurring in outcrops of felsic pyroclastics were explored just south of a small lake on the Semple-Hutt township boundary, about 300 m north of the 4-mile post. Hollinger reported no gold assays; however, Gledhill (1926) had earlier reported an assay of 0.01 ounce of Au per ton from a quartz vein on this property.

[1]Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.
[2]Assessment Files Research Office, Ontario Geological Survey, Toronto.

Diamond drilling on a small lenticular body of serpentinized ultramafic rock, located in Semple Township midway between the two previously discussed gold prospects, intersected a 0.3 m wide mineralized breccia zone at the contact with the metavolcanics. Breccia fragments include felsic metavolcanics, serpentinized felsic metavolcanics, and serpentinized ultramafic rock; the black graphitic matrix of this breccia contains disseminated pyrrhotite and minor chalcopyrite. In places, diamond-drill core from the serpentinized ultramafic lens contained minor disseminated pyrrhotite. No assays for nickel were reported. Diamond drilling, in the vicinity of the large lenticular body of serpentinized ultramafic rock that straddles the power line in western Hutt Township, intersected disseminated pyrite in the felsic pyroclastics adjacent to the ultramafic body. No assays for copper or nickel were reported.

Hollinger also diamond drilled several holes west of Canoeshed Lake to test a prominent easterly-trending conductive zone along the main contact between the felsic pyroclastics and the mafic to intermediate flows. The conductive zone proved to be a graphitic tuff horizon occurring within intermediate to felsic tuffs and containing disseminated to massive pyrite.

J. LUKE [circa 1925] (35)

In the early 1920s, James Luke and D. Swain Sr. prospected a number of localized zones of disseminated pyrite. These zones occur in sericitized felsic metavolcanics adjacent to aplite and felsite dikes that outcrop along both banks of the Grassy River, north of Canoeshed Lake in northern Hutt Township. Samples taken by Gledhill (1926) did not contain any gold.

NORANDA EXPLORATION COMPANY (15)

Noranda Exploration Company held a group of six unsurveyed claims, MR38256, MR38257, MR38263, MR38268, MR38274 and MR38275, immediately north of Moray Lake in Zavitz Township. This claim group formed the western part of a larger group of claims in Hincks Township, immediately east of the map area. The Zavitz Township claims were previously held, in 1952, by Dominion Gulf Company.

The property, in both Zavitz and Hincks Townships, is underlain by an easterly-trending unit of felsic pyroclastics containing subordinate interbeds of mafic to intermediate flows, sulphide-facies iron formation, and pyrite-bearing graphitic tuff. A serpentinized, ultramafic to mafic, sill-like body intrudes the metavolcanics near Moray Lake; both the sill and the enclosing metavolcanics are synclinally folded about a west-plunging axis located just south of Moray Lake.

In 1964 and 1965, Noranda Exploration carried out ground magnetic and electromagnetic surveys over the entire claim group and put down seven diamond-drill holes, totalling 890 m. Drill hole No. 8, collared on the Zavitz-Hincks township boundary north of Moray Lake in claim MR38268 (*see* Figure 3), intersected a 1.2 m wide section of intermediate to felsic tuff containing up

to 60 percent pyrite, with minor pyrrhotite and chalcopyrite. Approximately 400 m along strike to the southeast, near the southeast end of Moray Lake in Hincks Township, drill hole No. 1 intersected several zones of massive to disseminated pyrite-pyrrhotite mineralization containing minor chalcopyrite, sphalerite, and galena, in intercalated intermediate to felsic tuff, tuff-breccia, and graphitic tuff. Drill hole No.5, put down on a conductive zone approximately 500 m along strike to the southeast of hole No.1 (*see* Figure 3) intersected an 11 m section of massive sulphides, consisting of approximately 75 percent pyrite and 10 percent pyrrhotite, in intermediate to felsic pyroclastics[1]. The bottom 1.8 m section of this sulphide zone contains about 10 percent pyrite and 70 percent pyrrhotite, with minor disseminated galena and specularite. No assay values were reported for any of these sulphide zones.

Noranda Exploration also drilled several conductive zones near and adjacent to the contact between the felsic metavolcanics and the sill-like body of ultramafic to mafic rocks. These conductive zones proved to be pyrite-bearing graphitic tuff horizons in the metavolcanics.

In addition to the Moray Lake base metal prospect, Noranda Exploration also examined a gold-bearing quartz vein in syenite near the western end of a small oval-shaped stock of porphyritic syenite, located about 400 m northwest of Moray Lake in southeastern Zavitz Township. This gold showing is described as the Robinson occurrence (property 16).

NORTH MOHER LAKE OCCURRENCE (3)

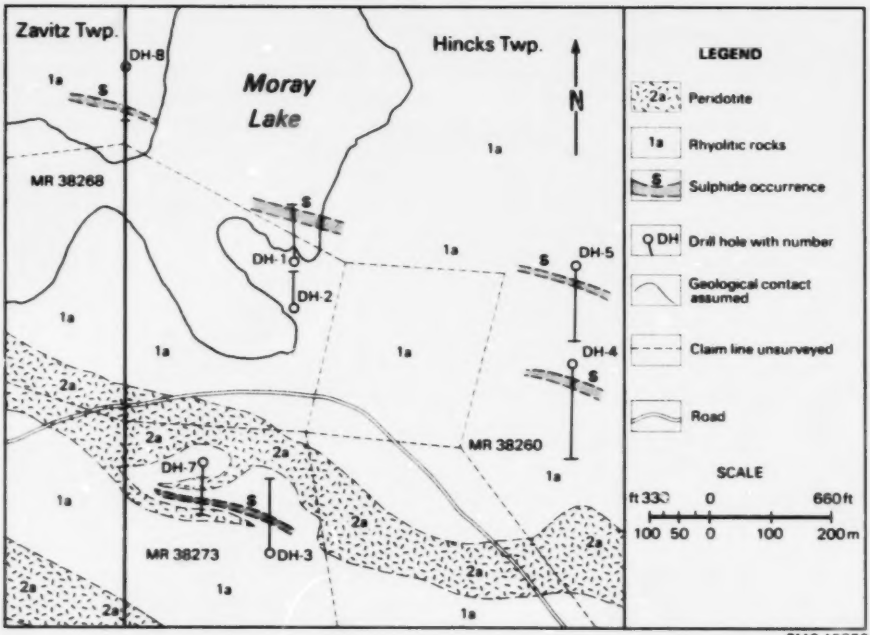
During the 1968 field season, a molybdenite-bearing quartz vein was observed cutting the amphibolitized mafic metavolcanics west of North Moher Lake, in northwestern Moher Township. The quartz vein, which is exposed for about 6 m, strikes northwestward across the easterly-trending, sharply defined contact between the metavolcanics and the granitic Moher Pluton. Disseminated molybdenite was observed both in the quartz vein and in the adjacent amphibolitized metavolcanic wallrock over a strike length of about 3 m. One grab sample collected by the author and analyzed by the Geoscience Laboratories, Ontario Geological Survey, Toronto did not contain any gold.

PCE EXPLORATIONS LIMITED [1965] (27)

PCE Explorations Limited formerly held a group of 27 unsurveyed claims, MR41365 to MR41379 inclusive and MR41389 to MR41400 inclusive, surrounding the easterly-trending differentiated ultramafic-mafic sill complex and enclosing mafic to intermediate metavolcanics southwest of Foy Lake in southeastern Semple Township.

The property was previously held in 1952 by Dominion Gulf Company; therefore, the general geology and early exploration of the property is dis-

[1]Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.



SMC 15256

Figure 3–General geology of the sulphide zones and location of surface diamond-drill holes on the property (15) of Noranda Exploration Company in southeastern Zavitz Township.

cussed in detail in the section dealing with Dominion Gulf Company (property 24).

In 1965, PCE Explorations carried out ground magnetic and electromagnetic surveys of the property but no follow-up diamond-drill program was reported.

In 1968, part of the ground was held by Probe Mines Limited (property 28).

PHELPS OCCURRENCE (14)

Phelps Dodge Corporation of Canada Limited formerly held a group of eight unsurveyed claims, MR39153 to MR39160 inclusive, located immediately north and northwest of Dexter Lake in southern Zavitz Township. The property straddles the contact between a thick unit of mafic to intermediate metavolcanics and an older unit of felsic metavolcanics, the latter consisting largely of pyroclastics.

In 1965, Phelps Dodge completed an electromagnetic survey over the claims and subsequently diamond-drilled two holes, totalling 80 m, to test a conductive zone. The holes intersected disseminated pyrite in intercalated intermediate to felsic pyroclastics and subordinate graphitic tuff.

PROBE MINES LIMITED (28)

In 1968, Probe Mines Limited held a group of 7 unsurveyed claims, MR46859 to MR46865 inclusive, surrounding the western end of the differentiated ultramafic-mafic sill southwest of Foy Lake in southeastern Semple Township.

The property had previously been investigated by Dominion Gulf Company in 1951-1952 and by PCE Explorations Limited in 1965. Exploration work by these companies is discussed in the section dealing with Dominion Gulf Company (property 24) and PCE Explorations Limited (property 27). No record of exploration work carried out in 1968 was submitted by Probe Mines.

ROBINSON OCCURRENCE (16)

In 1938, H.G. Robinson of Matachewan discovered gold-bearing quartz veinlets and stringers in sheared and silicified syenite near the eastern end of a small stock of porphyritic syenite, situated about 400 m northwest of Moray Lake in southeastern Zavitz Township. The following year, Howey Gold Mines Limited optioned the property and reported that grab samples assayed up to 0.42 ounce of Au per ton[1].

[1]Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

In 1941, Sylvanite Gold Mines Limited examined the surface workings; they reported two parallel trenches about 4 m apart and each measuring about 3 m in width by 24 m in length. The trenches exposed altered syenite cut by quartz veinlets and stringers which make up about 1 percent of the rock; the steeply dipping veinlets vary in strike from N30°W to N60°E and range in width from 5 to 51 cm. Sylvanite reported assays of up to 0.27 ounce of Au per ton[1] across a 2.4 m wide and 37 m long zone of silicified syenite cut by numerous quartz stringers and well-mineralized with disseminated pyrite.

In 1965, Noranda Exploration Company examined the same syenite stock and reported a new gold occurrence in a quartz vein near the western end of the stock[1]; the original Robinson gold prospect is located near the eastern end of this stock. A selected sample, taken by Noranda Exploration from a 15 cm wide mineralized quartz vein, assayed 0.75 ounce of Au per ton, 3.90 ounces of Ag per ton, and 0.45 percent Pb[1].

SOMMERVILLE OCCURRENCE (1)

C.L. Sommerville formerly held a small group of unsurveyed claims near the eastern shore of Peterlong Lake in central Beemer Township. The property is underlain by amphibolitized mafic metavolcanics, intruded in places by dikes of fine- to medium-grained granite, diorite, and quartz feldspar porphyry. In 1954, a 25 m pack sack diamond-drill hole was put down; the hole intersected amphibolite cut by numerous felsic dikes; the amphibolite contained minor pyrite and pyrrhotite.

SPIRIT LAKE MINES LIMITED (29)

In 1968, Spirit Lake Mines Limited held a group of 33 unsurveyed claims, MR40850, MR40851, MR42984, MR42985, MR42972 to MR42975 inclusive, MR46300 to MR46303 inclusive, MR47731 to MR47742 inclusive, and MR49549 to MR49557 inclusive, straddling the Moher-Semple township boundary near Little Redstone Lake.

The property is underlain by mafic to intermediate flows with intercalated subordinate units of intermediate to felsic pyroclastics. Two narrow, discontinuous bands of iron formation are intercalated with the metavolcanics southeast of Little Redstone Lake. A large, Middle to Late Precambrian diabase dike strikes northeast across the center of the property.

In 1965, Newmont Exploration of Canada Limited carried out ground magnetic and electromagnetic surveys over most of the property and mapped the claims at a scale of 1 inch to 200 feet. Most of the ground follow-up work by Newmont was concentrated on the southernmost band of iron formation, located southwest of Little Redstone Lake. Near the southwest shore of this lake,

[1]Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

Newmont stripped and trenched a 90 m length of the iron formation, a sulphide-rich section consisting largely of disseminated to massive pyrite and pyrrhotite with very minor chalcopyrite. About 460 m along strike to the southeast of this zone, Newmont stripped and trenched a second, 30 m long section of the same iron formation band. This section was largely magnetite-chert iron formation, and sulphides were sparse or absent. Samples from the sulphide-rich portions of the iron formation yielded only trace amounts of copper, nickel, and zinc.[1]

In 1968, Spirit Lake Mines completed ground magnetic and electromagnetic surveys over the property and subsequently diamond drilled eight holes, totalling 948 m. These holes intersected one or the other of the two bands of iron formation in areas where both sulphide and magnetite mineralization were known or suspected from geophysical results. Minor chalcopyrite was reported in some core sections containing disseminated to massive pyrite and pyrrhotite; however, reported assays for copper did not exceed 0.10 percent[1]. Most of the diamond drilling by Spirit Lake Mines was concentrated in the sulphide-rich section of the southernmost band of iron formation where Newmont Exploration of Canada Limited had previously carried out an extensive stripping and trenching program.

SYLVANITE OCCURRENCE (2)

In 1935, Sylvanite Gold Mines Limited, through their subsidiary Erie Canadian Mines Limited, optioned the J.C. Nelson gold prospects in Beemer and English Townships. The western portion of this property, along the northern shore of Telluride Lake in east-central Beemer Township consisted of five surveyed claims, TRS1760, TRS1771, TRS1772, TRS1887, and TRS3254 plus several adjoining unsurveyed claims. This portion of the former Nelson property is described here, while the eastern portion of the property, including the gold occurrence in patented claim TRS1759 near the 4-mile post on the Beemer-English township boundary, is described as the F. Boychuck (West Muskasenda group) property (5).

The occurrence is largely underlain by mafic to intermediate metavolcanics containing subordinate sill-like bodies of metagabbro. In 1935 and 1936, the company examined and sampled three gold-quartz vein showings in the sheared metavolcanics; all three occurrences are situated close to the contact of a metagabbro sill. The following description of these occurrences is taken from company reports[2].

Near the northeastern corner of Telluride Lake, in the southeastern part of claim TRS1887, Sylvanite sampled a 1 m wide quartz vein. A selected grab sample yielded an assay of 1.7 ounces of Au per ton, although most samples returned only trace amounts of gold. Trenching and sampling were also carried

[1] Assessment Files Research Office, Ontario Geological Survey, Toronto.
[2] Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

out on a second gold occurrence located in the northeastern part of the same claim TRS1887. Chip samples, taken from a narrow zone of quartz stringers in the sheared metavolcanics, yielded only trace amounts of gold; one selected sample assayed 0.16 ounce of Au per ton. Sylvanite examined a third gold prospect near the northwestern corner of Telluride Lake on surveyed claim TRS1760. Prior to their work, an old shaft had been sunk some 8 m into a large lens-shaped body of quartz in the sheared metavolcanics. Chip samples of some of the best mineralized quartz from the old rock dump assayed only traces of gold; samples taken from the quartz lens itself returned values of 0.44 ounce of Au per ton across 0.9 m and 0.37 ounce of Au per ton across 1.2 m.

No follow-up drilling has been reported on this property and all the claims, including the patented ones, reverted to the crown several years after completion of the work carried out by Sylvanite Gold Mines Limited.

TEXMONT OCCURRENCES (10, 17)

Texmont Mines Limited formerly held a group of 20 unsurveyed claims, MR40076 to MR40085 inclusive and MR40094 to MR40103 inclusive, straddling the English-Zavitz township boundary between Muskrat and Forks Lake, in the northeast corner of English Township (property 10) and the northwest corner of Zavitz Township (property 17). The property, which formed the southern part of Texmont's larger claim holdings to the north in Bartlett and Geikie Townships, was previously held by Dominion Gulf Company in 1952. The claims straddle the boundary between a felsic pyroclastic unit with minor intercalated iron formation units and a younger ultramafic-mafic to intermediate sequence. This is the same stratigraphic interval in which the Texmont nickel deposit occurs a few kilometres to the north in Bartlett and Geikie Townships (Pyke 1978b).

In 1965, Texmont carried out ground magnetic and electromagnetic surveys over the claim group. No follow-up diamond drilling was done on the claims within the map area; however, several holes were put down just to the north of the area, in the southeast corner of Bartlett Township. From these holes, Texmont reported[1] finely disseminated pyrrhotite and minor chalcopyrite and pentlandite in a narrow lens of ultramafic rocks between felsic pyroclastics and mafic to intermediate flows.

In 1966, Canadian Nickel Company Limited optioned the English-Zavitz claims and put down a single diamond-drill hole (footage unknown) near the northeast corner of English Township. The hole intersected intermediate to felsic metavolcanics containing disseminated pyrite and pyrrhotite[1], but no assays were reported.

[1] Assessment Files Research Office, Ontario Geological Survey, Toronto.

VIPOND AND HEARD OCCURRENCE (18)

In the mid-1960s, T.S. Vipond and C. Heard held a small group of claims on the west side of Zavitz Creek, approximately 1.3 km north of the southern boundary of Zavitz Township. The property, which is largely underlain by mafic to intermediate metavolcanics, was originally prospected in 1925 by James Luke. That same summer, Gledhill (1926) visited the property and examined a mineralized aplite dike and several associated quartz veins cutting the metavolcanics; samples from here did not yield any gold, but Gledhill (1926) reported that minor gold assays were obtained from an outcrop of "pyritized greenstone" in the southern part of the property. Vipond and Heard later reported that chip samples from a sheared and carbonatized metavolcanic tuff in the area of the old workings assayed 0.11 ounce of Au per ton[1].

VOYAGER EXPLORATIONS LIMITED (19)

Voyager Explorations Limited, in partnership with Silvermaque Mining Limited, held a group of 19 unsurveyed claims, MR38721 to MR38728 inclusive, MR39343 to MR39348 inclusive, MR39355, and MR39362 to MR39365 inclusive, situated 1.1 km northwest of Moray Lake in southeastern Zavitz Township.

The claims are largely underlain by mafic to intermediate pillow lavas. However, near the center of the claim group, a lenticular band of felsic tuff and tuff-breccia containing disseminated to massive pyrite and pyrrhotite occurs in the mafic to intermediate tuffs. The metavolcanics in this area are cut by numerous dikes and veinlets of quartz-feldspar porphyry, syenite, and granodiorite. Regionally, the area appears to lie near the center of a local structural dome, the result of the near surface emplacement of an unexposed late granitic intrusion. The mineralized felsic pyroclastics on the property probably correlate with the thick unit of felsic pyroclastics exposed in southeastern Zavitz Township and northeastern Hutt Township.

In 1965, Voyager Explorations carried out ground magnetic and electromagnetic surveys on the property. The magnetic and electromagnetic anomaly in claims MR38722 and MR39343 corresponds to an outcropping of disseminated to massive sulphides in felsic pyroclastics. Two large trenches were blasted in the exposed sulphide zone and six diamond-drill holes, totalling 433 m, were put down to test the copper potential of the conductive zone (Figure 4). Drill hole No.2, collared about 90 m southeast of the trenches (*see* Figure 4), intersected a 13.7 m section of felsic breccia containing an average of 1 to 2 percent disseminated pyrite and pyrrhotite; a 1.2 m section of massive pyrite and pyrrhotite within this mineralized zone assayed 0.46 percent Cu and 0.33 ounce of Au per ton[1]. Drill hole No.4, collared about 27 m southeast of hole No.2, intersected mineralized felsic breccia containing a 1.5 m section of mas-

[1]Resident Geologist's Files, Ministry of Natural Resources, Kirkland Lake.

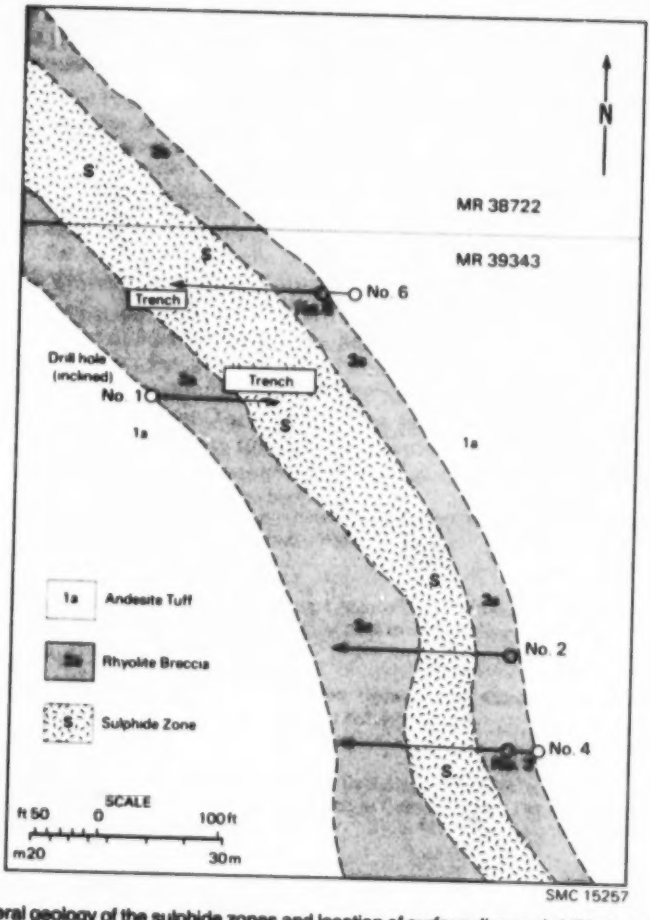


Figure 4–General geology of the sulphide zones and location of surface diamond-drill holes on the property (19) of Voyager Exploration Limited in southeastern Zavitz Township.

sive pyrite and pyrrhotite which assayed 0.91 percent Cu and 0.03 ounce of Au per ton[1].

Drill core sections of the sulphide zone in the vicinity of the trenches assayed only trace copper; selected samples from the trenches, taken by the author, contained trace amounts of copper and no gold (analyses by the Geoscience Laboratories, Ontario Geological Survey, Toronto).

The geophysical work carried out by Voyager Explorations indicated a second, less prominent conductive zone situated about 400 m along strike to the northwest of the one they had drilled. There is no record of the company having drilled this second anomaly.

WEST NIGHTHAWK LAKE OCCURRENCE (20)

In 1967, the author found a mineralized quartz vein cutting an outcrop of black, variolitic, mafic pillow lava. This outcrop had been recently exposed along a temporary logging access road and is located about 1.1 km due west of the north end of West Nighthawk Lake in east-central Zavitz Township. The exposed vein ranges in width from 8 to 30 cm and contains minor disseminated pyrite and chalcopyrite. Samples assayed by the Geoscience Laboratories, Ontario Geological Survey, Toronto did not contain any gold.

[1]Resident Geologist's Files, Ministry of Natural Resources, Kirkland Lake.

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	PAGE
Abitibi Belt	3
Abitibi dike swarm	23
Actinolite	6, 8, 9
Actinolitic flows	8
Agglomerate	9-13 *passim*
Agmatitic breccia	19
Alaskite	20
Alford-McCall gold prospect	44
Amygdules	8
Anomalies:	
Airborne	32
Electromagnetic	43, 52
Magnetic	32, 43, 52
Anticlinal axis	18
Anticlinal cross-fold	29
Anticlines	12, 26
Asbestos, cross-fibre	31, 38, 39, 40
Assays	36-44 *passim*, 48-54 *passim*
Aureoles, contact metamorphic	6, 8, 14
Barlow-Ojibway, glacial Lake	25
Bartlett Tp.	10, 11, 16, 26, 28
Basalt, tholeiitic	6
Basaltic flows	9
Batholith	5, 18
Bedding, graded	11
Benedict-Burrows Fault	27
Breccia:	
Agmatitic	19
Felsic	33
Flow-top	8, 9
Mineralized	45
Pillow	9
Burrows-Benedict Fault	27
Campbell Lake ice-contact deposits	26
Canadian Johns-Manville Co. Ltd.	40
Canadian Nickel Co. Ltd.	51
Carbonate-rich rock, green	15
Carbonatized ultramafic rockz	10
Chalcopyrite	9, 21, 30-46 *passim*, 51, 54
Chapleau I ice marginal position	26
Chapleau I Moraine	25
Chert	9
Chert-magnetite iron formation	12
Colour index of metavolcanics	6
Conductive zones	33, 34, 38, 44, 45, 48, 54
Cork Lake	39, 42
Cropsey iron prospect	38
Cross-folding	5, 26, 29
Cyprus Exploration Corp. Ltd.	36, 37
Daniel Mining Co. Ltd.	31, 40
Dexter Creek	12
Dexter Lake	38, 48
Diabase dike swarm, Matachewan	22, 27
Diamond-drill holes	18, 30-52 *passim*
Figures	35, 53
Dike swarms:	
Abitibi	23
Matachewan	22, 27
Sudbury	24
Disconformity	13
Dominion Gulf Co.	11, 31
Douglas Tp.	25
Dragfolds	28, 43
Edal Mines Ltd.	44
English Lake	9, 12, 29, 44
English Lake Fault	28
Enrichment, secondary	36
Epidote	8
Stockworks	17
Veins	17
Epidote-carbonate veins	34
Erie Canadian Mines Ltd.	50
Esker	14
Esker complexes	25
Esker sand	33
Fallon Tp.	22
Faults:	
Burrows-Benedict	27
English Lake	28
Grassy River	27
Mattagami River	27
Parting Lake	28
Peterlong Lake-Kapiskong Lake	27, 28
Redwing	28, 29
Scott Lakes	28
Feeder-zones	10
Felsic breccia	33
Felsic tuff	18, 34, 37, 41
Flow-breccia	34
Flows	8, 9
Actinolitic	8
Basaltic	9
Interflow units in;	8, 39
Marker horizon in;	9
Pillowed	9
Thicknesses of;	8
Tuffaceous	9
Units of;	6, 9
Flow-top breccia	8, 9
Folding:	
Cross-folds	5, 26, 29
Dragfolds	28, 43
Structure	5
Forks Lake	8, 51
Foy Lake	9, 17, 33, 39, 46, 48
Fracture zones	29
Gabbro:	
Granophyric	16, 17
Magnetic	16
Galena	43, 46
Geike Tp.	11, 24, 26

PAGE

Glacial Lake Barlow-Ojibway 25
Glaciation 25-26
Gold-bearing quartz stringer zone . . . 29
Gold-bearing quartz veins 21, 50
Gold-bearing zones 36
Gold prospects:
  Alford-McCall 44
  Nelson 37, 50
  Saville 44
Granophyric gabbro 16, 17
Graphitic tuff . 33, 34, 37, 44, 45, 46, 48
  Horizons 13
  Pyrite-bearing 45
Grassy River 13, 27, 30, 33, 45
Grassy River Fault 27
Greenstone, pyritized 52

Halliday Dome 10
Halliday Tp. . . . . 13, 26-32 *passim*
Hincks Tp. 24, 30, 45
Homoclinal sequence 6
Howey Gold Mines Ltd. 48
Hutt Creek 41

Ice-contact deposits, Campbell Lake . . 26
Ice flow direction 25
Ice marginal position, Chapleau I 26
Iron formations:
  Chert-magnetite 12
  Magnetite-chert . . . 11, 13, 15, 38, 40, 41, 43, 50
  Oxide-facies 3, 14, 15, 38
  Pyrite-bearing 44
  Pyrite-magnetite-bearing 44
  Pyrite-pyrrhotite-chert 38
  Siliceous sulphide-bearing 30
  Sulphide facies 3, 14, 15, 38, 45
Iron prospect, Cropsey 38

Jeff Lake 9
Junction Lake 9

Kapiskong Lake 8, 19, 25, 25, 27
Kapiskong Lake-
    Peterlong Lake Fault 27, 28
Kapuskasing Structural Zone 27
Kettle depressions 25
Kitchiming Lake . . 8, 9, 15, 26, 30, 41, 42

Lavas, pillow 44
  Mafic 41
  Variolitic 8, 42, 54
Little Redstone Lake 14, 49
Loadcast structures 11
Luke Lake 12, 18, 33, 34, 38, 39

McArthur Tp. 25
Mafic metavolcanics, tremolitic 8
Mafic pillow lavas 41
Magnetic conductive zone 38

PAGE

Magnetic expressions 23
Magnetic gabbro 16
Magnetic rocks, ultramafic 17
Magnetite 6, 11, 14, 15, 22, 24, 41-43, 50
  Titaniferous 16, 17
Magnetite-chert iron formation . . 11, 13, 15, 38, 40, 41, 43, 50
Magnetite-ilmenite 24
Marker horizon in flows 9
Matachewan diabase dike swarm . . 22, 27
Mattagami River Fault 27
Meltwater channel 25
Metagabbro complex,
  Muskasenda Lake 37
Metamorphism 5
  Assemblages 6
  Aureoles 8, 14
  Contact 5, 8
  Regional 5, 6, 8
Metavolcanics:
  Sequence 8
    Thickness 9
  Sheared 44, 51
  Stratigraphic succession 3, 9
  Tremolitic mafic 8
  Tholeiitic 9
Midlothian Tp. 26
Mineralization 50
  Volcanogenic-type 30
Mineralized breccia 45
Mining Corp. of Canada Ltd. 40
Molybdenite 46
Montrose Lake 9
Montrose Tp. 30
Moraine, Chapleau I 25
Moray Lake 11, 18, 32, 38, 39, 45, 46, 48, 52
Mountjoy River 37
Musgrove Tp. 26
Muskasenda Lake 6, 11, 12, 16, 21, 26, 29, 34, 37
Muskasenda Lake layered metagabbro
    sill complex 15-17, 34, 37
Muskrat Lake . . . . . 7-15 *passim*, 28, 31, 32, 40, 41, 51

Nelson gold prospect 37, 50
Newmont Exploration of
    Canada Ltd. 49, 50
Nickel ore body at Texmont Mine . . . 31
North Moher Lake 46

Ojibway-Barlow, glacial Lake 25
Oxide facies iron formation . 3, 14, 15, 38

Parti. g Lake 18, 28, 31, 33, 39, 40
Parting Lake Fault 28
PCE Explorations Ltd. 48
Pentlandite 51

PAGE

Peteriong Lake 8, 19, 20, 23, 25, 27, 31, 49
Peteriong Lake-Kapiskong Lake Fault 27, 28
Pillow breccia 9
Pillowed flows 9
Pillow lavas 44
  Mafic 41
  Variolitic 8, 42, 54
Probe Mines Ltd. 40
Pyrite . . . . . 9, 13-15, 21, 22, 30, 33-54 *passim*
  In graphitic tuff 15, 45
  In iron formation 44
  In quartz stringer zones 43
Pyrite-magnetite-bearing iron formation 44
Pyrite-pyrrhotite-chert iron formation 38
Pyritic tuff 15
Pyritized greenstone 52
Pyritized wallrocks 31
Pyroclastics . . . . 11-14, 34, 41-52 *passim*
Pyrrhotite . . . 9, 13, 14, 30, 33-54 *passim*

Quartz:
  Stockworks 17, 21, 34
  Stringers . . . 34, 37, 39, 43, 44, 49, 51
    Gold-bearing 29
    Pyrite-bearing 43
  Veinlets 48, 49
  Veins . . . . . 15, 17, 21, 29-31, 34, 36 43-54 *passim*
    Gold-bearing 21, 50
    Molybdenite-bearing 46
Quartz-calcite 34
Quartz-carbonate veins 29, 36, 43
  System 34
Quartz-potassium-feldspar-carbonate veins 43

Redstone River 29, 39, 43, 44
Redwing Creek 33
Redwing Fault 28, 29

Sampling 50
  Bulk 42
Sand, esker 33
Sand dunes 25
Saville gold prospect 44
Scott Lakes Fault 28
Serpentine 17
Shear-fracture system 34
Shearing 11, 28
  In metavolcanics 44, 51
  In wallrocks 31
  Zones 29, 34, 36, 37
Shear Lake 34
Sill complex, layered metagabbro:
  Muskasenda Lake 15-17, 34, 37

PAGE

Silvermaque Mining Ltd. 52
Sothman Tp. 28, 32, 42
Specularite 46
Sphalerite 46
Spinifex-texture 9-11, 18
Steve Lake 8
Stockworks
  Epidote 17
  Quartz 17, 21, 34
  Quartz-calcite 34
Stratigraphic succession of metavolcanics 3, 9
Stringers, quartz 34, 37, 39, 43, 44, 49, 51
  Pyrite-bearing 43
Structural dome 52
Structural Zone, Kapuskasing 27
Sudbury dike swarm 24
Sulphide-bearing iron formation, siliceous 30
Sulphide facies iron formation . . . 3, 14, 15, 38, 45
Sulphide minerals:
See: Chalcopyrite; Galena; Molybdenite; Pyrite; Pyroclastics; Pyrrhotite; Sphalerite.
Sylvanite Gold Mines Ltd. 37, 49
Synclinal axis 17
Syncline 18, 41
Synform 5, 26

Telluride Lake 50, 51
Texmont Mine 10
  Nickel orebody 31
Tholeiitic basalt 6
Tholeiitic metavolcanics 9
Titaniferous magnetite 16, 17
Transterre Exploration Ltd. 34
Tremolite 6, 8, 9
Trenching 36, 37, 42, 49, 50, 52, 54
Tuff 9, 11, 12, 14, 44, 46, 52
  Felsic 18, 34, 37, 41
  Graphitic 33, 34, 37, 44-46, 48
    Horizons 13
  Pyrite-bearing 15, 45
Tuff-breccia 46
Tuffaceous units, interflow 9

Ultramafic magnetic rocks 17
Ultramafic rocks, carbonatized 10

Variolitic pillow lava 8, 42, 54
Veinlets, quartz 48, 49
Veins:
  Epidote 17
  Epidote-carbonate 34
  Quartz 15, 17, 21, 29-31, 34, 36, 44, 46, 49, 50, 52, 54
    Gold-bearing 21, 50

PAGE

Molybdenite-bearing 46
Quartz-calcite 34
Quartz-carbonate 29, 34, 36, 43
Quartz-potassium-feldspar-carbonate 43
Volcanism 3
Cycles 7, 8
Texture 6
Volcanogenic-type mineralization . . . 30

PAGE

Wellington Creek 12
Wellington Lake 9, 41
West Nighthawk Lake . . . 13, 19, 21, 26, 37, 54
Wick's lumber road 12, 44
Wisconsinan ice margin 25

Xenoliths 19, 20, 21

Zavitz Creek 11, 12, 24, 52

MAPS NOT

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